

SERVICE MANUAL

Elefant 650 USA

Part. N. 49826

N. 49826





SERVICE MANUAL

Elefant 650 USA

Copyright by
CAGIVA Motor Italia S.p.A.
21100 Schiranna - Varese - Italy

1° Edizione
Printed in Italy
Stampato N° - Print No. 49826
Elaborazioni Tecniche D.E.Ca - LUGO



CAGIVA Motor Italia S.p.a., and **CAGIVA** North America accepts no liability for any inaccuracies or omissions in this publication, although every possible care has been taken to make it as complete and accurate as possible. All procedures and specifications subject to change without prior notice, and may not apply to every country.

ELEFANT 650 SERVICE MANUAL
© 1986 by
CAGIVA Motor Italia S.p.A.
1st edition, JANUARY 1986
All rights reserved. any reprinting or unauthorized use without the written permission
of **CAGIVA** Motor Italia S.p.A. or **CAGIVA** North America Inc., is expressly
prohibited.

Printed in Italy

© 1986 by

CAGIVÀ Motor Italia S.p.A.

1st edition, JANUARY 1986

All rights reserved. any reprinting or unauthorized use without the written permission of **CAGIVA** Motor Italia S.p.A. or **CAGIVA** North America Inc., is expressly prohibited.

Printed in Italy

EMISSION CONTROL INFORMATION

To protect the Environment in which we all live, Cagiva has incorporated Crankcase Emissions (1) and Exhaust Emissions (2) Control Systems in compliance with applicable regulations of The United States Environmental Protection Agency.

(1) Crankcase Emission Control System

This system eliminates the release of crankcase vapors into the atmosphere. Instead, the vapors are routed to the combustion chamber through the air cleaner and the carburetor.

(2) Exhaust Emission Control System

This system reduces the amount of pollutants discharged into the atmosphere by the exhaust of this motorcycle.

(3) Evaporative Emissions Control system: those motorcycles sold in California are equipped with an evaporative emissions control system. See the California Supplement to this Manual.

The Clean Air Act, which is a Federal Law covering Motor Vehicle Pollution, contains what is commonly referred to as the Act's "Tampering Provisions".

"Sec. 203(a) The following acts and the causing thereof are prohibited ...

- (3) (A)** for any person to remove or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with regulations under this title prior to its sale and delivery to the ultimate purchaser, or for any manufacturer or dealer knowingly to remove or render inoperative any such device or element of design after such sale and delivery to the ultimate purchaser.
- (3) (B)** for any person engaged in the business of repairing, servicing, selling, leasing, or trading motor vehicles or motor vehicle engines, or who operates a fleet of motor vehicles knowingly to remove or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with regulations under this title following its sale and delivery to the ultimate purchaser ...".

"NOTE"

The phrase "remove or render inoperative any device or element of design" has been generally interpreted as follows:

- 1. - Tampering does not include the temporary removal or rendering inoperative of devices or elements of design in order to perform maintenance.*
- 2. - Tampering could include:*
 - A. Maladjustment of vehicle components such that the emission standards are exceeded.*
 - B. Use of replacement parts or accessories which adversely affect the performance or durability of the motorcycle.*
 - C. Addition of components or accessories that result in the vehicle exceeding the standards.*
 - D. Permanently removing, disconnecting, or rendering inoperative any component or element of design of the emission control systems.*

WE RECOMMEND THAT ALL DEALERS OBSERVE THESE PROVISIONS OF FEDERAL LAW, THE VIOLATION OF WHICH IS PUNISHABLE BY CIVIL PENALTIES NOT EXCEEDING \$ 10,000 PER VIOLATION.

TAMPERING WITH NOISE CONTROL SYSTEM PROHIBITED

Federal Law prohibits the following acts or the causing thereof:

- (1) The removal or rendering inoperative by any person other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new vehicle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use, or (2) the use of the vehicle after such device or element of design has been removed or rendered inoperative by any person.

Among those acts presumed to constitute tampering are the acts listed below:

1. - Removal of/or puncturing the muffler, baffles, header pipes or any other component which conducts exhaust gases.
2. - Removal of/or puncturing of any part of the intake system.
3. - Lack of proper maintenance.

Foreword

This manual was written by **CAGIVA** Motor Italia S.p.a. primarily for use by **CAGIVA** dealers and their qualified mechanics. It is not possible to put an entire mechanic's education into one manual, so it is assumed that persons using this book to perform maintenance and repairs on **CAGIVA** motorcycles have a basic understanding of the mechanical concepts and procedures inherent in motorcycle repair technology.

Repairs or service attempted without such knowledge will very likely not only cause expensive damage to the motorcycle, but will render it unfit for service and unsafe. The Alazzurra motorcycles are high performance, high tech bikes and therefore repair and maintenance techniques suitable for less sophisticated motorcycles may not be appropriate to these fine hand crafted machines. If you have any question regarding any of the procedures in this Manual, it is essential that you consult a factory trained **CAGIVA** mechanic.

In addition to the information given in this Service Manual, Service Bulletins are issued to **CAGIVA** Dealers from time to time, which cover interim engineering changes and supplementary information. Service Bulletins should be consulted for complete information on the models covered by this manual.

Important Notice

Read this manual carefully and pay special attention to statements proceeded by the following words:

WARNING

: Indicates a possibility of severe personal injury or loss of life if instruction are not followed.

CAUTION

: Indicates a possibility of personal injury or equipment damage if instructions are not followed.

"NOTE" Give helpful information.

Replacement Parts

When replacement parts are required, use only genuine **CAGIVA** parts or parts with equivalent characteristics including type, strength and material. Failure to do so may result in product malfunction and possible injury to the operator and/or passenger.

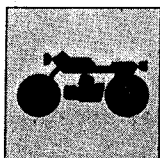


.....

Summary

Section

- A** Specifications
- B** Torque
- C** Maintenance
- D** Adjustments
- E** General operations
- F** Engine disassembly
- G** Engine overhauling
- H** Engine re-assembly
- I** Suspension and wheels
- J** Hydraulic control clutch release
- L** Brakes
- M** Electric system
- N** Troubleshooting guide
- W** Specific tools

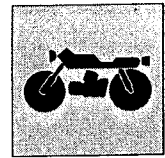


SPECIFICATIONS

A

ENGINE

Type.....	Twin-cylinder, 90° "L", 4 stroke, Desmo SOHC, air cooled
Displacement.....	649.6 c.c.
Bore x Stroke.....	82x61.5 mm
Compression, ratio	10:1
Horse power/r.p.m.....	57.5 CV (42.3 Kw/7500 r.p.m.)
Max. engine speed.....	8.500 r.p.m.
Lubrication.....	By gear pressure pump (Wet sump)
Carburetor.....	Dell'Orto PHF 36 x2
Ignition.....	Ducati Electronic
Alternator.....	Ducati or Saprisa Alternator, 12 V - 300 W
Ignition module.....	BOSCH
H. T. coil.....	Motoplat
Autom. advanced ignition timing.	5°/1700 r.p.m.; 25°/2600 r.p.m.; 32° over 2900 r.p.m.
Spark plugs.....	CHAMPION - L 82 YC
Electrode gap.....	0.6 ÷ 0.7 mm (0.023 ÷ 0.028 in)
Battery.....	12 V - 14 Ah
Head lamp bulbs.....	12 V - 55/60 W
Rear parking light bulbs.....	12 V - 5 W
Turning light bulbs.....	12 V - 21 W
Tail light bulbs.....	Double-filament 12 V - 21/5 W (Stop + Plate lights)



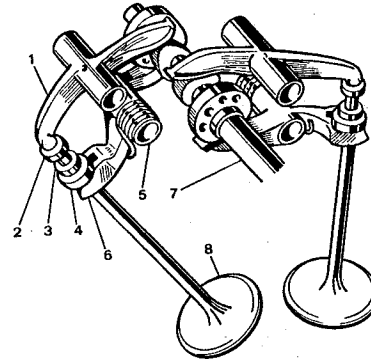
DESMODROMIC VALVE GEAR SYSTEM

Your **CAGIVA** motorcycle features the famous DUCATI «Desmodromic» valve gear system. The «Desmodromic» valve gear system ensures high performances over the entire speed range.

Rocker arms to valves clearance (inlet and exhaust valves).

Opening rocker arm: 0.10 mm (0.0039 in).

Closing rocker arm: 0.00 ~ 0.02 mm (0 ~ 0.00078 in)



The Desmodromic Valve Gear System - 1. Opening rocker arm (upper). 2. Opening rocker arm adjuster. 3. Split rings. 4. Closing rocker arm adjuster. 5. Return spring. 6. Closing rocker arm (lower). 7. Camshaft. 8. Valve.

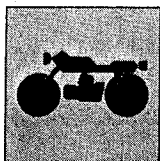
The camshaft is belt driven and valve timing is:

VALVE			
Inlet	Open	80°	BTDC
	Close	38°	ABDC
Exhaust	Open	39°	BBDC
	Close	80°	ATDC

TRANSMISSION

Transmission type.....	5 speed constant mesh
Clutch type	Multiplate dry clutch, hydraulically operated
Primary drive.....	Helical gears: 36/71
Final drive.....	O - ring chain, 5/8" x 3/8"
Final ratio.....	14/44
Gear ratios.....	1st: 14/43
	2nd: 20/37
	3rd: 24/32
	4th: 27/29
	5th: 29/27
Overall Drive Ratio (5th gear)	0.173





SPECIFICATIONS

FRAME

Type.....	Double down tube cradle, 4130 box section tube
Rake	20° 30'
Steering angle.....	35° to either side
Trail.....	114 mm (4.49 in)
Tire size: Front	90/90 - 21
Rear	130/90 - 17 or 130/80 - 17
Brake: Front.....	Single drilled floating disc, ø 260 mm (10.2 in) Brembo
Rear.....	Single drilled disc, ø 240 mm (9.44 in) Brembo
Rims in light alloy: Front	21" - 1.85"
Rear.....	17" - 2.75"
Suspension type: Front	Telescopic fork
Rear.....	"Soft-Damp" type, box sectional aluminium swingarm, single shock

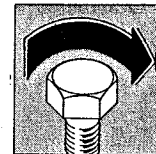
DIMENSIONS

Maximum length.....	2250 mm (88.6 in)
Wheel base	1530 mm (60.2 in)
Maximum height	1250 mm (49.2 in)
Ground clearance	250 mm (9.8 in)
Seat height	880 mm (34.6 in)
Gas tank total capacity	17.5 lts (4.6 gals)
Reserve	5 lts (1.3 gals)
Dry weight	184.5 Kg (406.7 lbs)

FLUIDS AND GREASE

	Type of fluid	Capacities
Gasoline.....	94 - 98 octane rate	17.5 lts (4.6 gals)
Engine oil and filter	CASTROL GTX2 or equivalent	3.3 lts (3.5 US qts)
Front fork.....	SAE 15	0.5 lts (0.53 US qt)
Front/rear brake circuits	DOT 4 CASTROL Disc Brake Fluid, anti-vapour lock	-
Hydraulic clutch	DOT 4 CASTROL Disc Brake Fluid	-
Drive chain	CASTROL GTX2 or equivalent	-
Tachometer/Speedmeter	CASTROL LM Grease or equivalent	-

TORQUE

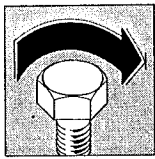


B

ENGINE

PART	TORQUE		REMARK	THREAD DIAMETER AND PITCH
	METRIC (Kg - m)	ENGLISH (ft - lbs)		
CYLINDER HEADS FIXING NUTS	3.5	25.5	-	Ø 10 P 1.5
CONROD CAPS FIXING SCREWS	6.5	47	*	Ø 10 P 1.0
PRIMARY TRASMISSION GEAR FIX. NUT	11+12	77.5+87	-	Ø 22 P 1.0
CLUTCH DRUM FIXING NUT	14+15	101+108.5	-	Ø 20 P 1.0
TIMING SYSTÈM SHAFT GEAR FIX. NUT	4	29	-	Ø 14 P 1.0
TIMING SHAFT RING NUT	3.5+4	25.5+29	-	Ø 15 P 1.0
ALTERNATOR ROTOR FIXING NUT	11	79.5	-	Ø 20 P 1.0
TIMING BELT STRETCHER FIX. SCREW	2.5	18	-	Ø 8 P 1.25
OIL PUMP GEAR FIX. NUT	2+2.5	14.5+18	-	Ø 8 P 1.0
IGNITION SPARK PLUG	2.5	18	-	Ø 14 P 1.25
COVERS AND CRANKCASES BOLTS	0.8+1	6+7	-	Ø 6 P 1.0
COVERS AND CRANKCASES BOLTS	2+3	14.5+22	-	Ø 8 P 1.25
CLUTCH CONTROL DISC FIX. BOLTS	0.8+1	6+7	-	Ø 6 P 1.0





TORQUE

CHASSIS

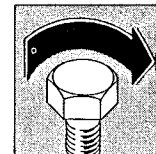
PART	TORQUE		REMARK	THREAD DIAMETER AND PITCH
	METRIC (kg - m)	ENGLISH (ft - lbs)		
FRONT AXLE	7+7.5	50.5+54	-	Ø 14 P 1.5
REAR AXLE NUT	7+7.5	50.5+54	-	Ø 16 P 1.5
REAR SHOCK ABOSORBER BOLTS	4	29	-	Ø 12 P 1.75
STEERING STEM HEAD BOLT	2	14.5	-	Ø 8 P 1.25
STEERING STEM LOCKNUT	2.0	14.5	-	Ø 25 P 1
FRONT FORK TOP PLUGS	2.5	18	-	Ø 38 P 1.5
FRONT FORK DRAIN SCREWS	-	-	•	Ø 6 P 1
HANDLEBAR CLAMP BOLTS	2	14.5	-	Ø 8 P 1.25
ALLEN BOLT FROM BASE	1.5	11	-	Ø 6 P 1
DISC MOUNTING BOLTS - FRONT	2	14.5	-	Ø 8 P 1.25
DISC MOUNTING BOLTS - REAR	1.5	11	-	Ø 6 P 1
FRONT CALIPER MOUNTING BOLTS	4.0	29	-	Ø 10 P 1.5
REAR CALIPER MOUNTING BOLTS	4.0	29	-	Ø 8 P 1.25

NOTE: Marks used in "Remark"

- : Apply a non-permanent locking agent to the threads.
- * : Apply a liquid gasket to the threads or washer.



TORQUE



The table below, relating tightening torque to thread diameter and pitch, lists the basic torque for the bolts and nuts used on **CAGIVA** Motorcycles. However, the actual torque that is necessary may vary amount bolts and nuts with the same thread diameter and pitch. The bolts and nuts listed on Pg. B.1 vary to a greater or lesser extent from what is given in this table. Refer to this table for only the bolts and nuts not included in the table on Pg. B.1. All of the values are for use with dry solvent-cleaned threads.

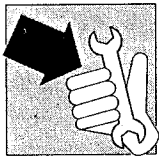
COARSE THREADS

DIA (mm)	PITCH (mm)	KG-M	FT-LBS
5	0.80	0.35 ÷ 0.50	30 ÷ 43 in-lbs
6	1.00	0.60 ÷ 0.90	52 ÷ 78 in-lbs
8	1.25	1.6 ÷ 2.2	11.5 ÷ 16.0
10	1.50	3.1 ÷ 4.2	22 ÷ 30
12	1.75	5.4 ÷ 7.5	39 ÷ 54
14	2.00	8.3 ÷ 11.5	60 ÷ 83
16	2.00	13.0 ÷ 18.0	94 ÷ 130
18	2.50	18.0 ÷ 25	130 ÷ 181
20	2.50	26 ÷ 35	188 ÷ 253

FINE THREADS

DIA (mm)	PITCH (mm)	KG-M	FT-LBS
5	0.50	0.35 ÷ 0.50	30 ÷ 43 in-lbs
6	0.75	0.60 ÷ 0.80	52 ÷ 69 in-lbs
8	1.00	1.4 ÷ 1.9	10.0 ÷ 13.5
10	1.25	2.6 ÷ 3.5	19.0 ÷ 25
12	1.50	4.5 ÷ 6.2	33 ÷ 45
14	1.50	7.4 ÷ 10.2	54 ÷ 74
16	1.50	11.5 ÷ 16.0	83 ÷ 116
18	1.50	17.0 ÷ 23	123 ÷ 166
20	1.50	23 ÷ 33	166 ÷ 239



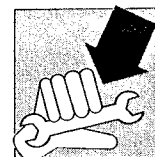


MAINTENANCE

C

PERIODIC MAINTENANCE CHART

Operation	Frequency	Which ever comes first ▼	* Odometer Reading Km (mi)											Refer to page
	Every		«SET UP»	500 (350)	1000 (650)	1500 (1100)	3000 (1900)	5000 (3000)	10000 (6300)	15000 (9500)	20000 (12500)	25000 (15600)	30000 (19000)	
EMISSION RELATED	 Valve clearance - check			•	•			•	•	•	•	•	•	A.2 H.5
	 Driving belt tension - check			•	•			•	•	•	•	•	•	H.26
	Cylinder head nuts - check			•					•		•		•	H.24
	 Fuel lines, clean carburetor Check synchronization			•	•	•	•	•	•	•	•	•	•	D.2 G.19
	Spark plug - clean and gap			•	•	•	•	•	•	•	•	•	•	M.8
	Air filter - clean							•		•		•		
	Air filter - replace	5 cleanings							•			•		
	 Carburetor - Idle speed			•	•	•	•	•	•	•	•	•	•	D.2
	Engine oil - Change	1 year		•	•		•	•	•	•	•	•	•	
	 Evaporative emission control System (California only)									•		•		
NON - EMISSION RELATED	Battery electrolyte level - check	Month	•	•	•	•	•	•	•	•	•	•	•	M.4
	Engine oil level - Check	Month	•	•	•	•	•	•	•	•	•	•	•	
	Oil filter - replace			•				•	•	•	•	•	•	
	Brake pad wear - check						•	•	•	•	•	•	•	L.2
	Brake fluid - check	Month	•	•	•	•	•	•	•	•	•	•	•	
	 Brake fluid - change	2 year												L.3 L.5
	 Brake light switch - check		•	•	•	•	•	•	•	•	•	•	•	



PERIODIC MAINTENANCE CHART

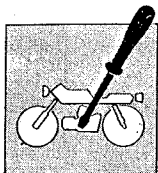
Frequency Operation		Which ever comes first Every	* Odometer Reading Km (mi)											Refer to page
			«SET UP»	500 (350)	1000 (650)	1500 (1100)	3000 (1900)	5000 (3000)	10000 (6300)	15000 (9500)	20000 (12500)	25000 (15600)	30000 (19000)	
Cluth - adjust							•		•	•	•	•	•	D.4
Clutch fluid - check		Month	•				•		•	•	•	•	•	J.1
 Clutch fluid - change		2 years												J.3
 Steering head play - check				•	•	•	•	•	•	•	•	•	•	D.6
 Swing-arm pivot lubrication								•	•	•	•	•	•	I.7
Wheels				•			•	•	•	•	•	•	•	I.1
Suspension				•	•	•	•	•	•	•	•	•	•	I.1
 Nuts, bolts, fastners - check				•				•		•		•		
Tire wear - check							•	•	•	•	•	•	•	
Drive chain - lubricate		500 km (350 mi)												
Drive chain slack - check		800 km (500 mi)												D.5
 Speedometer gear - lubricate		2 years												
 Master cylinder cup and dust Seal - replace (Brakes and clutch)		2 years												J.2 L.5
 Caliper piston and dust seal - replat		2 years												L.4
 Brake hose - replace Clutch hose - replace		4 years												L.4 E.8
Fuel hose - replace		4 years												
Spark arrester														D. 5



: In the interest of safety, we recommend these items be serviced only by an authorized **CAGIVA** dealer.

* : For higher odometer readings, repeat at the frequency interval established here.



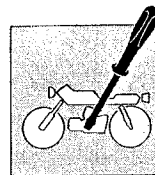


ADJUSTMENTS

D

- D.2 Carburetor synchronization. Idle adjustmen
- D.3 Throttle cable adjustment
- D.4 Choke cable adjustment
- D.4 Front brake lever adjustment
- D.4 Hydraulic clutch lever adjustment
- D.5 Drive chain adjustment
- D.6 Steering head bearings play adjustment



**Carburetor synchronization.**

Carburetors must be adjusted to open and close simultaneously.

Note: Valve clearance, spark plugs and ignition must be set properly before synchronizing the carburetors.

A. - Idle Speed.

1. Warm up engine.
2. Stop engine.
3. Install vacuum Gauge.

Note: Insure the gauge does not leak. Leaking will result in improper adjustment.

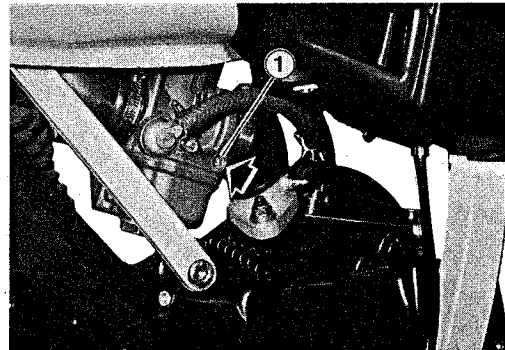
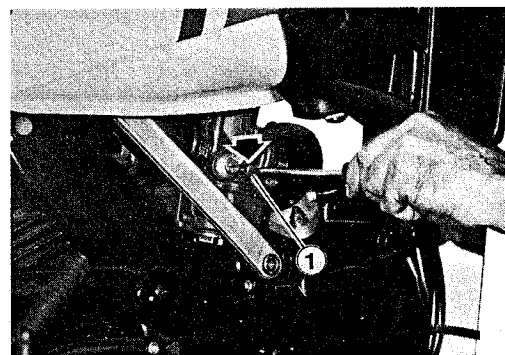
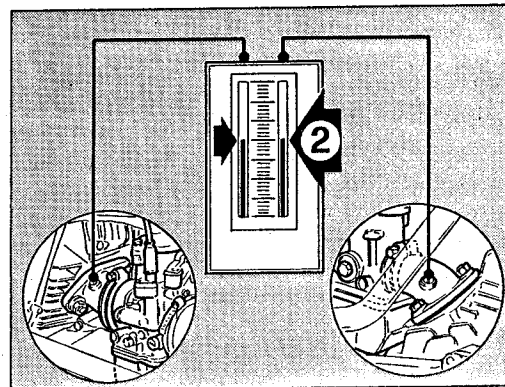
4. Start engine and leave it at idle speed.
5. Turn carburetors slide adjusting bolt ① until mercury columns from vacuum gage are even.
6. Turn adjusting bolt ① of both carburetors same number of turns until idling speed is reached.

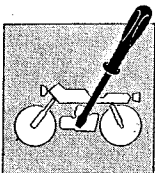
Idle speed: 900 ± 100 r.p.m.

7. Check for same height on vacuum Gauge ②.

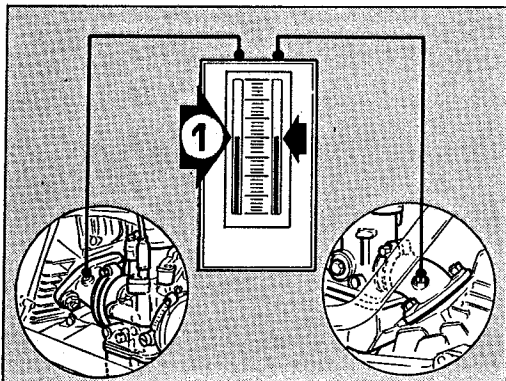
WARNING

- * Never run the engine in a closed area. The exhaust contains poisonous carbon monoxide gas.
- * Do not exceed 4000 rpm with gauges attached to carbs. Do not make sudden rpm increases with gauges attached.





ADJUSTMENTS



B. - Throttle cable adjustment.

Once idle speed is set, gradually accelerate up to 3.000 to 4.000 r.p.m. and check mercury columns in vacuum gauge.

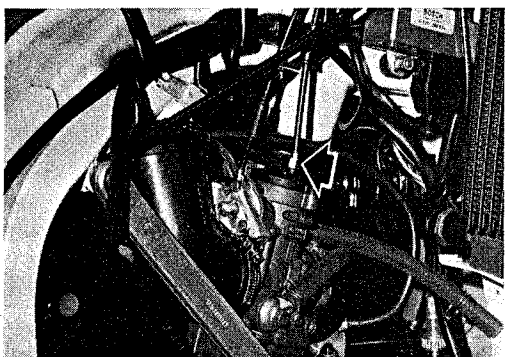
If uneven, adjust cable play by turning the cable adjuster of carburetor with higher mercury column.

Rev. the engine up to 4.000 r.p.m. for a fraction of a second two or three times, and check the synchronization again from idle speed.

Tighten locknut.

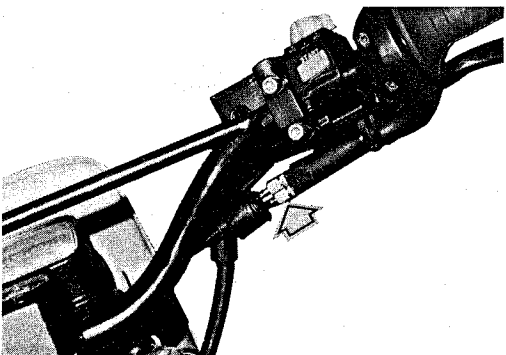
Adjust cable play by acting on cable adjuster at throttle control nut, until 2 + 3 mm (0.078 + 0.12 in) of play at the throttle grip is obtained.

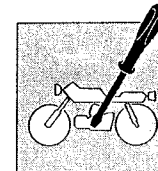
Tighten the locknut



WARNING

* Do not exceed 4.000 r.p.m. with gauges attached to carbs. Do not make sudden r.p.m. increases with gauges attached.





Chocke cable adjustment

Allow a free of 2.5 + 4 mm (0.1 + 0.16 in.).

Act on cable nut adjuster and tighten locknut.

Front brake lever adjustment.

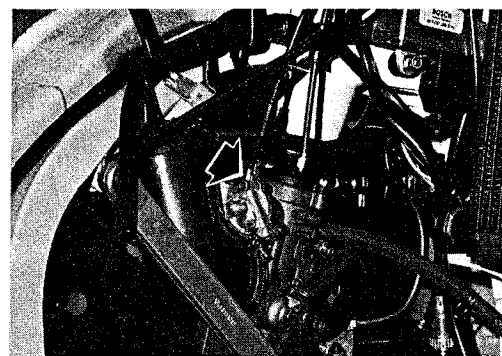
Allow a free play of 1 + 1.5 mm. (0.4 + 0.6 inch.).

Act on allen bolt to set proper play.

Clutch lever adjustment

Allow lever play of 1 + 1.5 mm (0.4 + 0.6 inch.).

Act on allen bolt to set proper play.



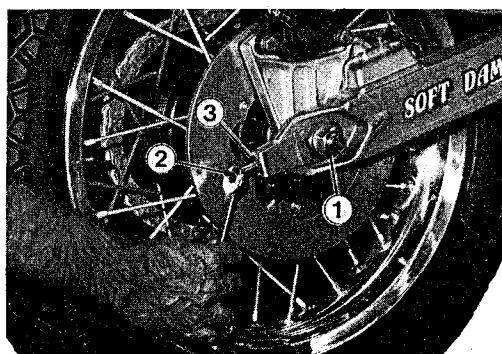
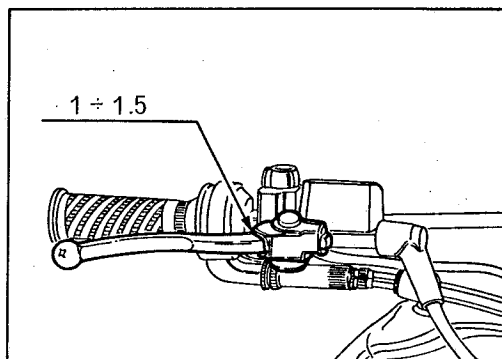
Drive chain adjustment.

- Set the motorcycle on its stand.
- Rotate the wheel to find the position where the chain is tightest and check the vertical movement shown on figure.

- If chain slack is more or less adjust the chain.

To adjust the chain:

- Loosen wheel axle nut ①.
- If chain is too tight, back out the left and right chain adjusting bolt ② evenly, and kick the wheel forward until the proper chain slack is reached.
- If chain is too loose, turn in the left and right chain adjusting bolt ② evenly until the drive chain has the correct amount of slack.
- Tighten wheel axle nut.



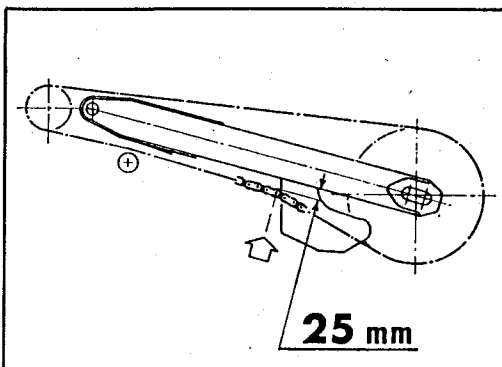
Note: To keep the chain and wheel aligned, turn adjusting bolts ② evenly.

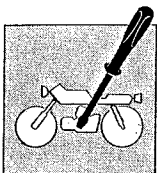
Wheel alignment can also be checked using the straightedge or string method.

WARNING

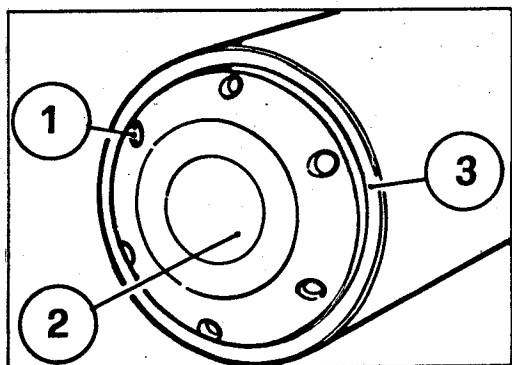
Misalignment of the wheel will result in abnormal wear, and may result in an unsafe riding condition.

Take care not to damage the brake hose. Damaging the brake line greatly reduces the brake line strength and causes brake fluid leakage, resulting in the loss of brake control.





ADJUSTMENTS



Spark Arrester Cleaning (U.S. model)

This motorcycle is equipped with a Spark Arrester approved for off-road use by the U.S. Forest Service.

It must be properly maintained to ensure its efficiency in accordance with the periodic Maintenance Chart.

CAUTION

- * The spark Arrester must be installed correctly and functioning properly to provide adequate fire protection.

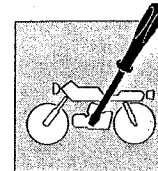
WARNING

- * To avoid burns, wear gloves if Spark Arrester is hot

- Remove Spark Arrester mounting bolts ①
- Pull cover ② and plates ③ out of the muffler.
- Clean carbon particles
- Install spark arrester.

WARNING

- * Never run the engine without Spark Arrester near combustible materials, hot particles may start a fire.
- * Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas. Breathing exhaust gas leads to carbon monoxide poisoning, asphyxiation, and death.

**Steering head bearings play adjustment.**

For safety, the steering should always be kept adjusted so that the handlebar will turn freely but have no play.

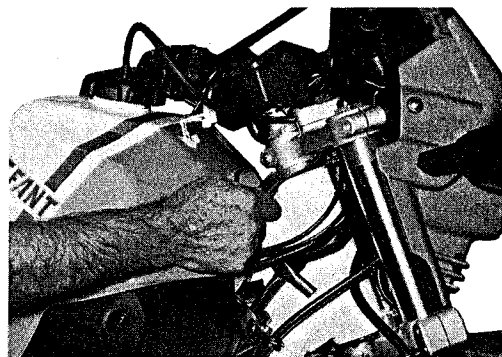
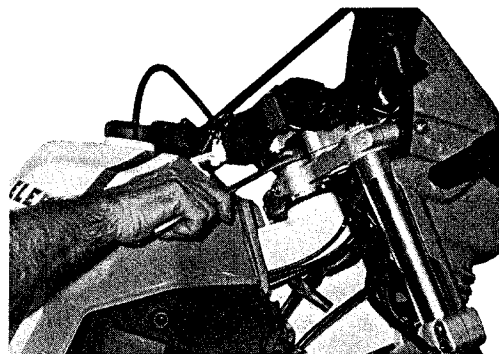
If the steering is too tight, it will be difficult to turn the handlebar quickly, the motorcycle may pull to one side, and the steering stem bearings may become damaged. If the steering is too loose, the handlebar will vibrate and the motorcycle will be unstable and difficult to steer in a straight line.

To check the steering adjustment:

- Set the motorcycle on a center stand.
- Lift the front wheel off the ground.
- From the straight forward position of the handlebar, slowly push the handlebar to either side (be sure that the cables and wiring harness do not interfere handlebar movement).
- If the handlebar begins to turn by the action of gravity and continues moving until the ridge on the stem base stops against the stop rod on the frame, the steering is not too tight.
- If the handlebar does not begin to turn by the action of gravity, the steering is too tight necessitating adjustment.
- Squat in front of the motorcycle and grasp the lower ends of the front fork. Push and pull the fork end back and forth. If play is felt, the steering is too loose, necessitating adjustment.

To adjust the steering:

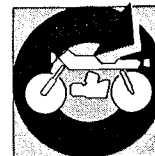
- Loosen stem head bolt
- Adjust play acting on steering stem locknut using the stem nut wrench
- Loosen top triple clamp allen bolts
- Tight on stem head bolt
- Tight on allen bolts





E

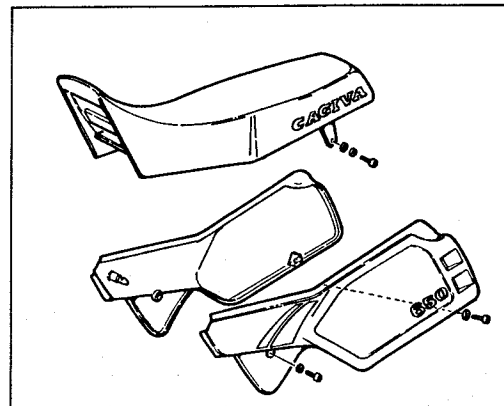
- E.2 Seat Removal
- E.2 Side covers removal
- E.2 Air scoops removal
- E.2 Gas tank removal
- E.3 Battery removal
- E.3 Air filter box removal
- E.3 Silencer removal
- E.4 Subframe removal
- E.4 Exhaust removal
- E.5 Oil cooler hoses removal
- E.5 Clutch cable removal
- E.5 Hydraulic clutch fluid hose removal
- E.5 Tachometer driving cable removal
- E.6 Carburetor removal
- E.7 Shift pedal linkage removal
- E.7 Drive chain removal
- E.8 Engine removal from frame

**Seat Removal:**

- Loose side allen bolts.
- Lift seat.

Side covers removal:

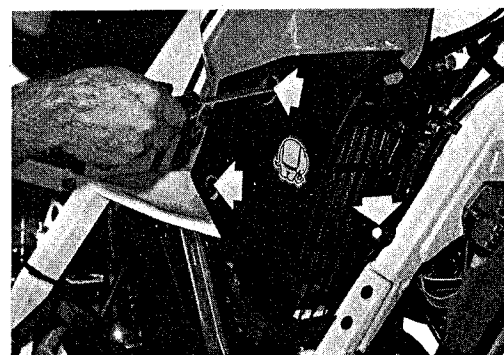
- Remove bolts and pull out side covers.

**Air scoops removal**

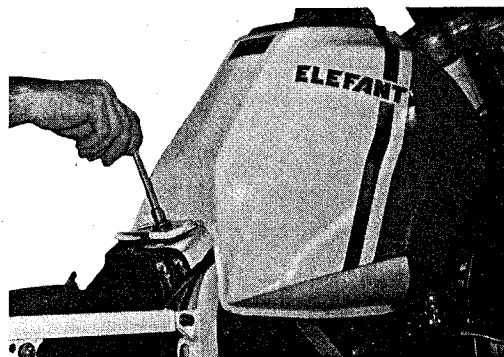
- Remove fixing bolts to gas tank and pull them forward.

Gas tank removal

- Be sure that both gas valves are closed.
- Remove gas hoses.
- Remove the rear gas tank fixing bolt.
- Lift rear of gas tank and slide it backwards.

**WARNING**

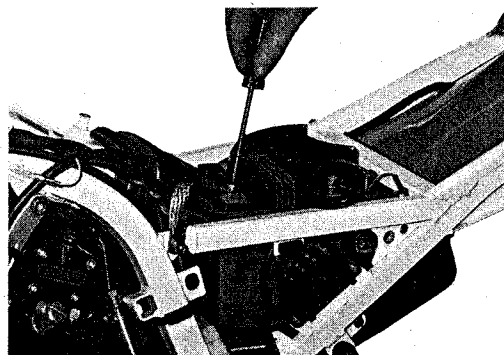
- * Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch off.
- * Do not smoke or allow flames or sparks in the area where the motorcycle is parked.

**Battery removal:**

- Remove seat and side panel.
- Remove negative wire.
- Remove positive wire.
- Remove rubber clamp.

WARNING

- * The battery contains sulfuric acid. Avoid contact with skin, eyes or clothing.





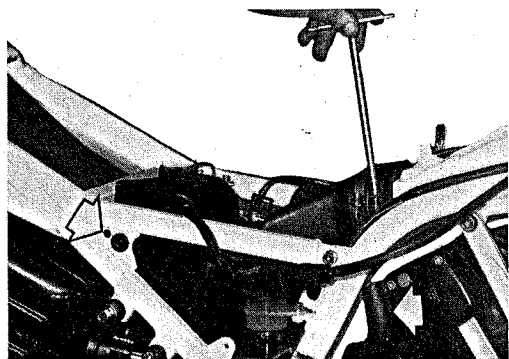
GENERAL OPERATION

Antidot: External: Flush with water
Internal: Drink large quantities of water or milk.
Follow with milk of magnesia, beaten egg or vegetable oil. Call physician immediately.
Eyes: Flush with water and get prompt medical attention.

- * KEEP OUT OF REACH OF CHILDREN
- * Batteries produce explosive gases. Keep sparks, flames and cigarettes away.
- * Always protect eyes when working near batteries.

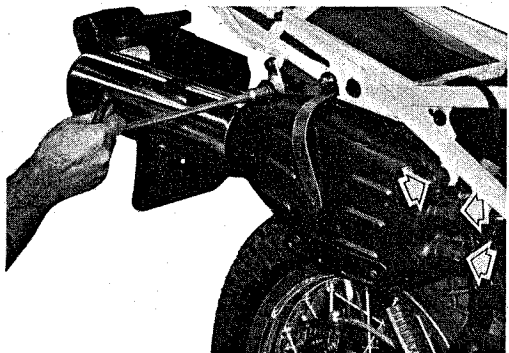
Air filter box removal:

- Remove fixing bolts on R.H. side.
- Loosen air filter to frame rubber hose clamp.
- Loosen crankcase breather rubber hose clamp.
- Remove air filter box pulling it up.



Silencer removal:

- Disconnect electrical wires going to tail lights, fuse box and starter relay.
- Loosen both exhaust to silencer clamps.
- Remove the two fixing bolts and remove silencer.

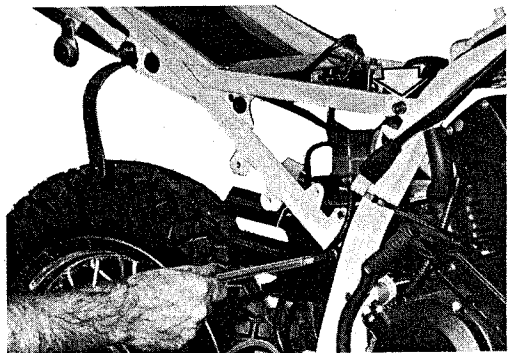


Subframe removal:

- Remove the aluminum support of passenger's footrest.
- Remove the four fixing bolts.
- Remove subframe.

CAUTION

- * When reassembling be sure that top left side fixing bolt is also attached to the two ground wires.

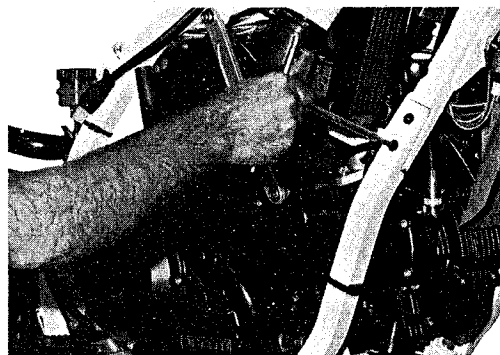




Removal of the bolted section of main frame:

- Remove skid plate.
- Remove all fixing bolts.
- Remove bolted section.

Note: * Note that rear brake pedal, and master cylinder will remain attached to the bolted section.

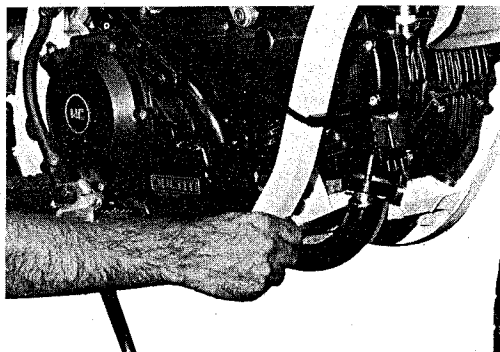


Exhaust removal:

- Remove the nuts from the header section ring nut.
- Remove header sections.

WARNING

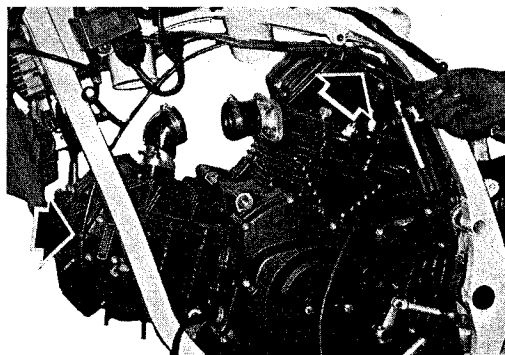
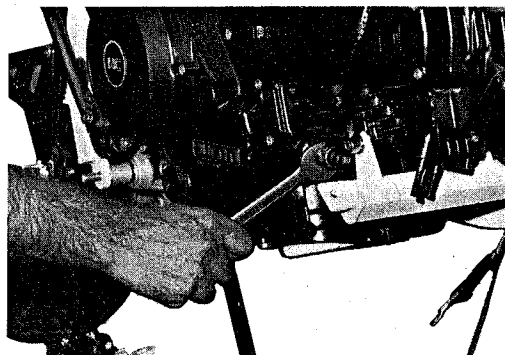
* Do not touch exhaust pipes or silencers unless cold.



Oil cooler hoses removal:

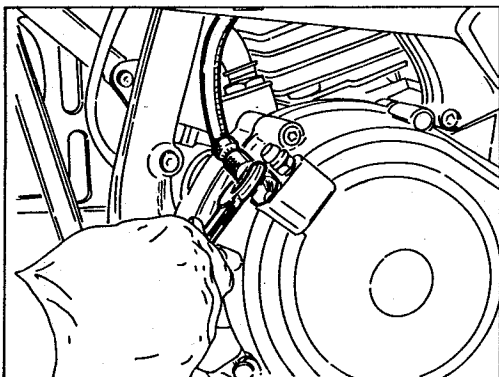
- Remove oil pressure switch wires.
- Remove oil pressure switch.
- Remove the banjo bolt at crankcase.
- Remove banjo bolts in cylinder heads and hoses.

Note: * Carefully remove gaskets so can be used when assembling the engine





GENERAL OPERATION



Hydraulic clutch fluid hose removal

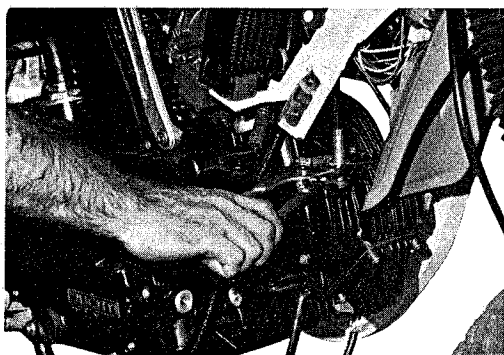
- Fit an appropriate length of clear plastic tubing over bleeder valve, loosen it, remove cover from handlebar container and let drain the fluid in appropriate container.
- Remove the banjo bolt on crankcase.

Note: * Clutch fluid is DOT 4

WARNING

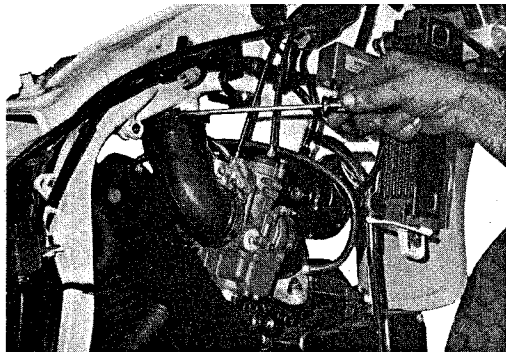
* Clutch fluid can cause eye irritation.

In case of contact with eyes, flush with plenty of water and get medical attention. KEEP BRAKE FLUID OUT OF REACH OF CHILDREN.



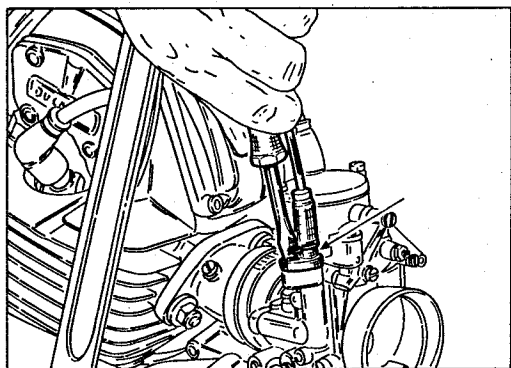
Tachometer driving cable removal

- With a pair of pliers loosen up knurled ring nut.
- Pull out driving cable.



Carburetors removal.

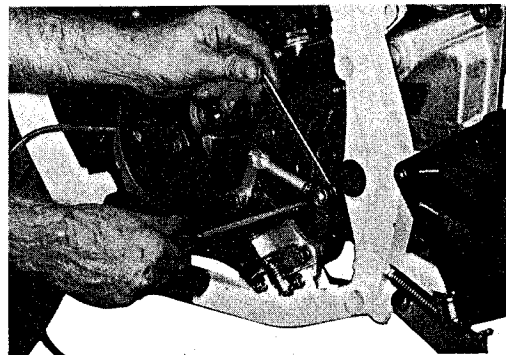
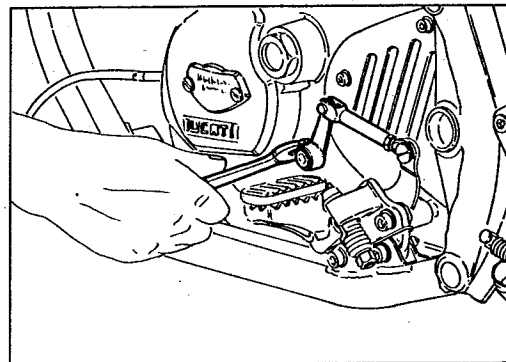
- Remove throttle cable from throttle grip on handlebar by pulling down the rubber cover placed underneath the throttle grip.
- Remove air filter rubber hose from both carburetors.
- Remove chocks from carburetors.
- Loosen clamps and pull carburetors out.





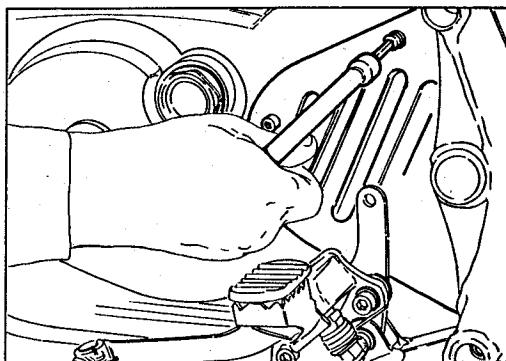
Shift pedal linkage removal.

- Remove bolt from shift pedal.
- Remove shift linkage short lever from shift axle.



Drive chain removal.

- Set motorcycle on its stand.
- Turn rear wheel until master link is on rear sprocket.
- Remove master link clip.
- Remove master link.
- Turn wheel backwards until chain lays completely on the ground.

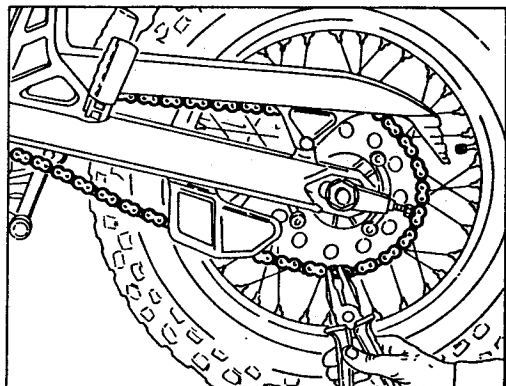


WARNING

- * Keep your fingers out of the chain and sprockets when rear wheel is moving. Serious physical damage can be obtained if caught by chain and sprockets.

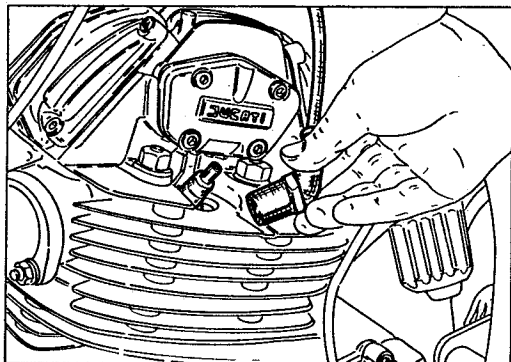
CAUTION

- * When chain is mounted back, be sure that the master link clip is mounted with its closed end pointing to the direction of the chain movement.



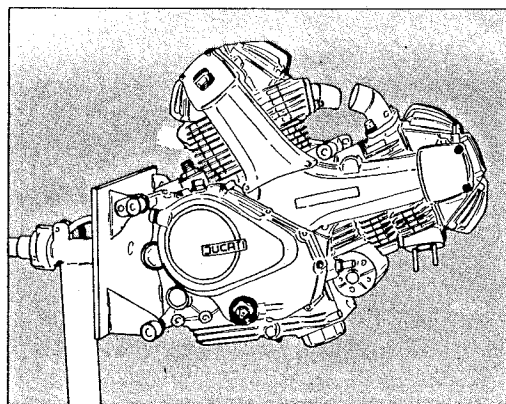
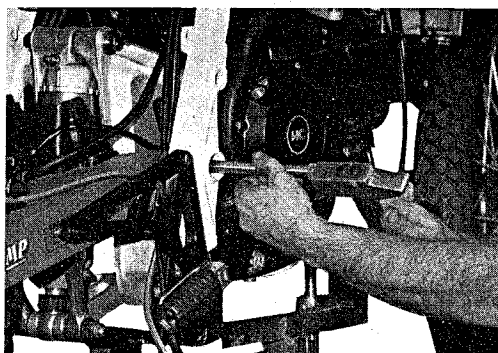
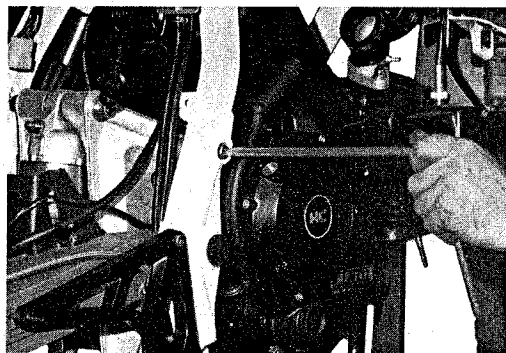
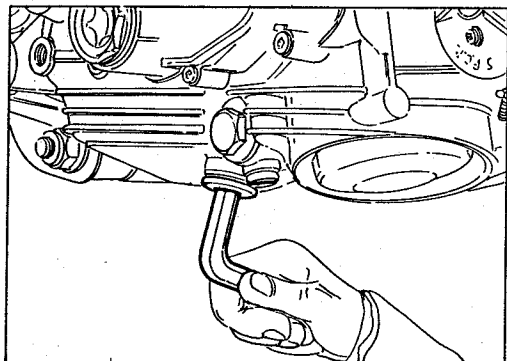


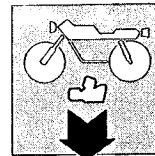
GENERAL OPERATION



Engine removal from frame.

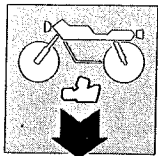
- Remove sparkplug cables,
- Drain engine oil.
- Disconnect all electric cables (pick-up, alternator, electric start motor, and neutral light wire).
- Remove head steady.
- Place a hydraulic jack under the engine sump, remove engine top rear mounting bolt.
- Remove swingarm pivot bolt and remove engine from frame.
- Place engine on stand.



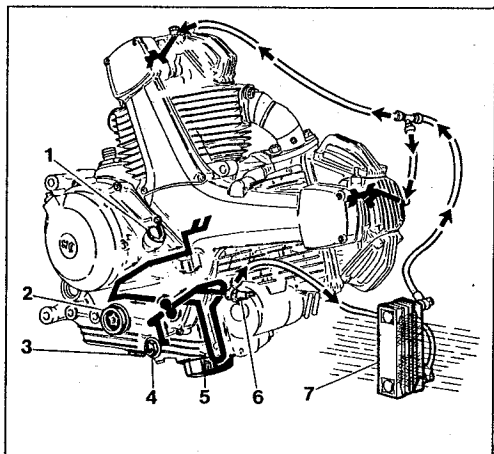
**F**

F.2 - F.3	Camshaft driving belts and pulleys	F.15	Primary trasmission pinion
F.4	Cylinder head	F.16	Center crankcases
F.5	Cylinder and piston	F.17	Oil pressure adyusting valve
F.6	Ignition cover	F.18	Camshaft driving shaft
F.6	Pick-up back plate	F.18	Crankshaft
F.7	Alternator rotor	F.18	Shift fork rod
F.7	Ignition flywheel	F.18	Selector drum
F.8	Camshaft driving gear	F.19	Shift forks
F.9	Starter gears	F.19	Countershaft
F.10	Starter motor	F.19	Mainshaft
F.10	Countershaft sprocket	F.20	Valve covers
F.11	Shift mechanism	F.20	Upper rocker arms
F.11	Clutch cover	F.21	Valves
F.12 - F.13	Clutch	F.22	Camshaft
F.14	Oil pump	F.23	Lower rocker arms





ENGINE DISASSEMBLY



Engine Lubrication System.

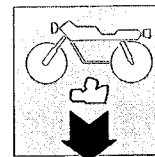
1. Oil filler cap
2. Oil level indicator
3. Drain plug
4. Screen filter
5. Oil filter cartridge
6. Oil pressure switch
7. Oil cooler

Oil change.

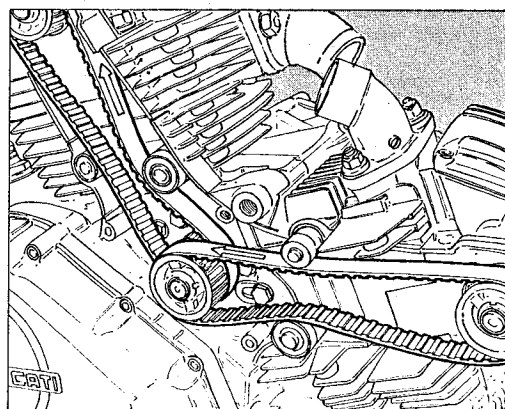
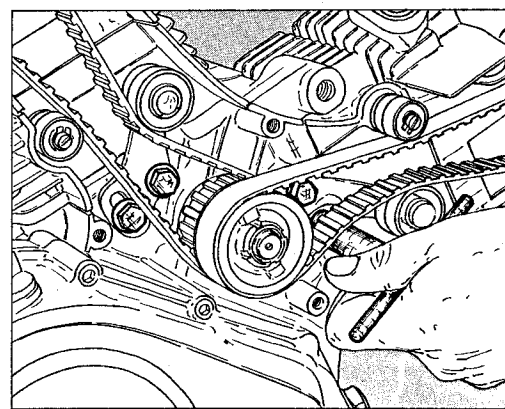
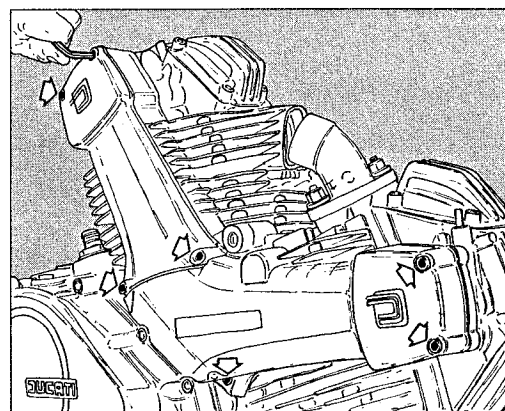
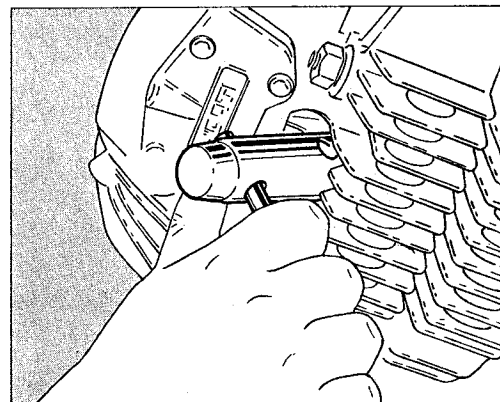
- Drain oil.
- Remove, clean and install screen filter.
- Change oil cartridge.
- Fill up with new oil to maximum level.
- Start engine, let it run for one minute and stop it.
- Check oil level again and add if needed.

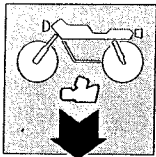
CAUTION

* Oil level must be checked with motorcycle in vertical position and standing on both wheels.

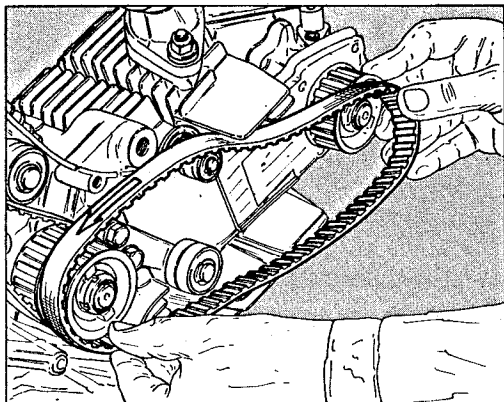


- Make sure that engine is properly installed on its support.
- Remove spark plugs.
- Remove toothed belts covers.
- Loosen both belt tensioners and move them away from belts.
- With a felt pen or similar marker, mark rotation (counterclockwise) and the cylinder camshaft they drive (V for vertical cylinder and H for horizontal cylinder).





ENGINE DISASSEMBLY

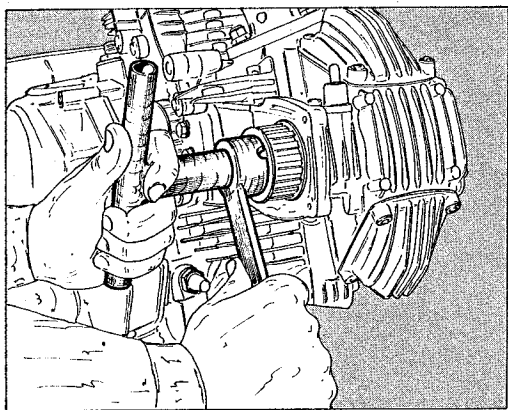
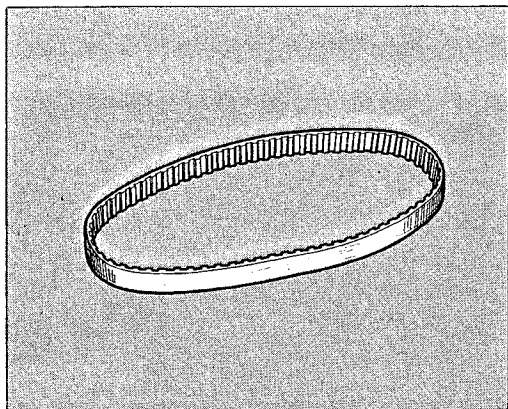


Toothed belt removal.

- Remove the belt with your hands only, do not try with any tool.

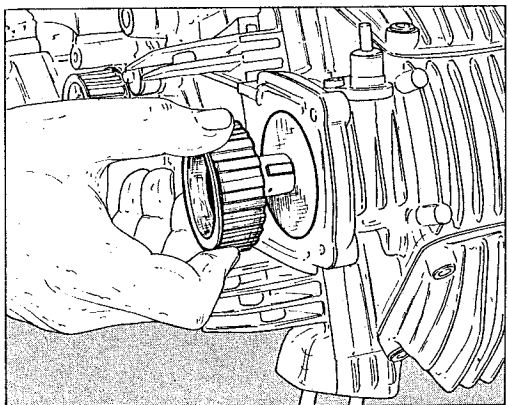
CAUTION

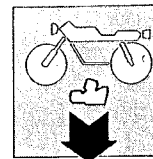
- * Sharp bending of toothed belt (minimum bending radius is 0.78 in), oil, petrol, solvents, may cause permanent damage to the belts.



Pulley Removal.

- Hold pulley with tool ☆ 42415 and loosen up holding nut with tool ☆ 42414.
- Remove pulley, woodruff key and guiding washer.





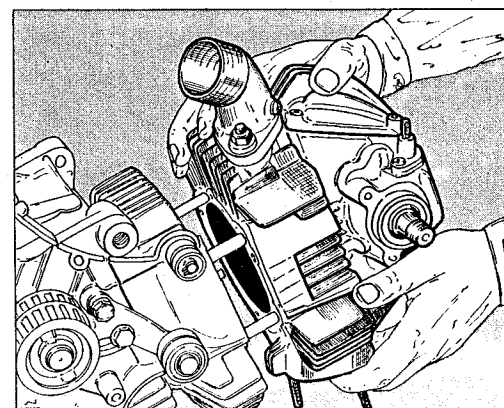
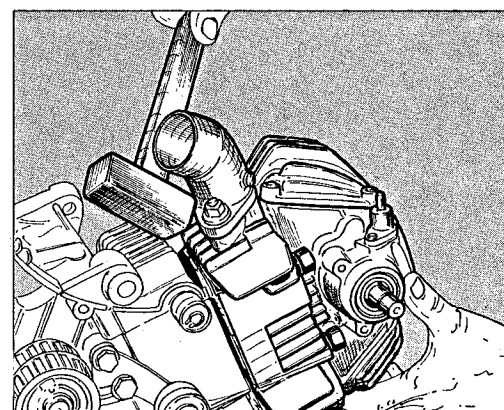
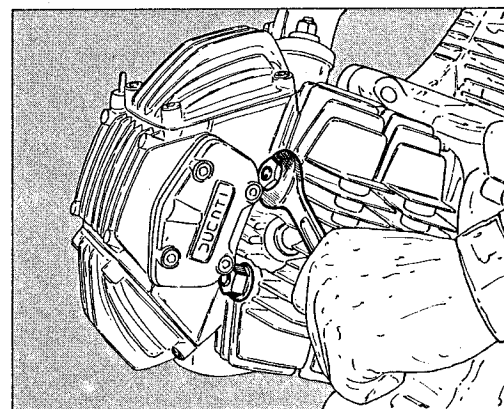
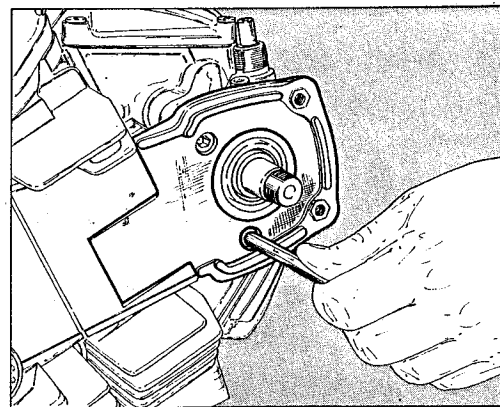
Cylinder Head

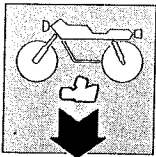
- Remove rubber back cap.

CAUTION

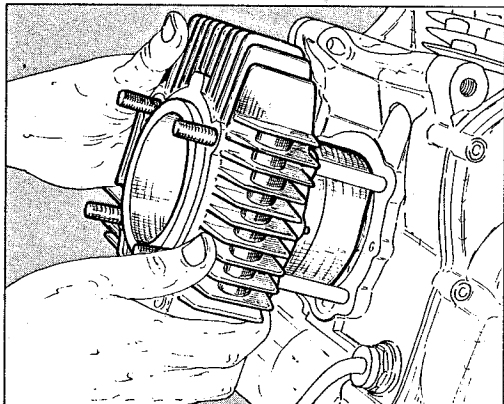
* Follow next steps only if engine is cold. If engine is still warm due to the natural expansion of the aluminum, the stress that cylinder studs have, increases the torque needed to loosen cylinder head nuts.

- Pull out cylinder head tap slightly if needed with rubber or plastic hammer.





ENGINE DISASSEMBLY



Cylinder.

- Remove cylinder, tap it slightly if necessary.

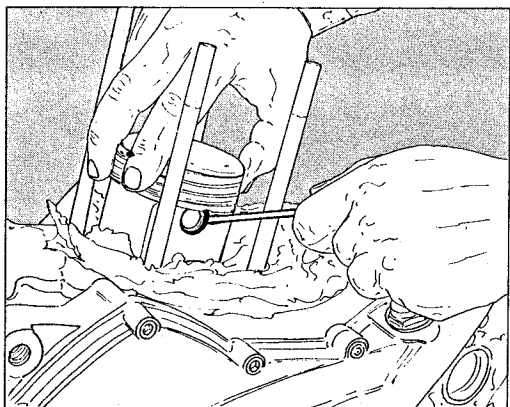
CAUTION

- * Hold piston to avoid hitting crankcase and possible damage.

- Place clean rag under the piston, clogging crankcase opening to avoid dropping foreign parts.
- Remove piston pin retaining rings.

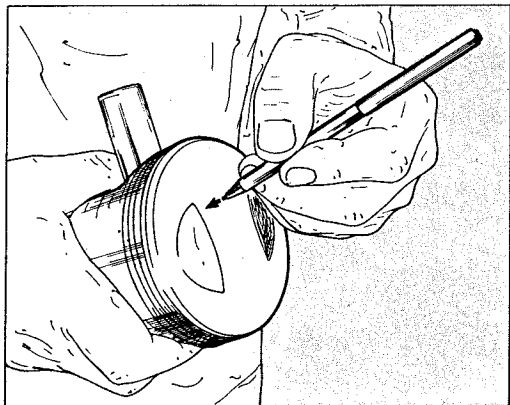
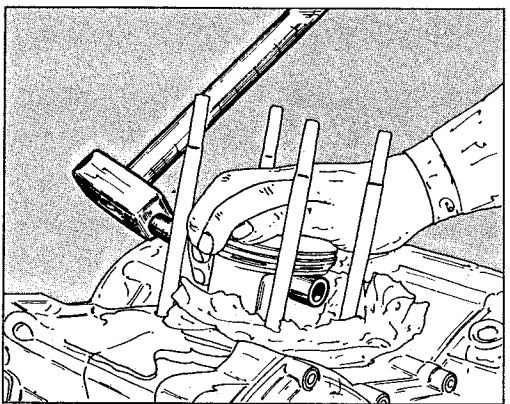
WARNING

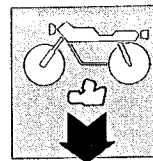
- * These rings are highly compressed in the ring groove and may "fly-out" with considerable force when pried out of the groove. Safety glasses or goggles must be worn while removing or installing retaining rings.



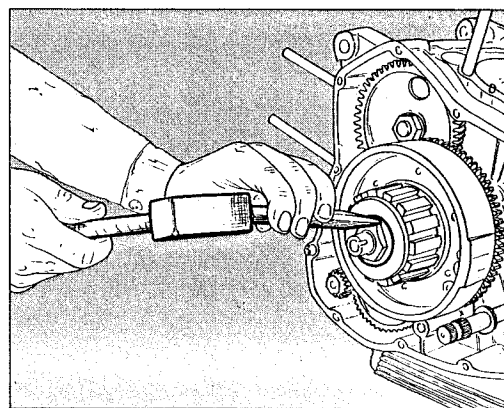
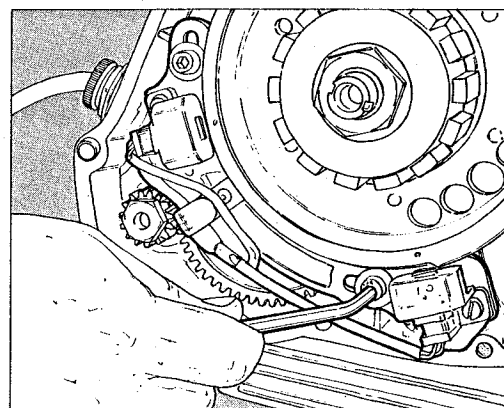
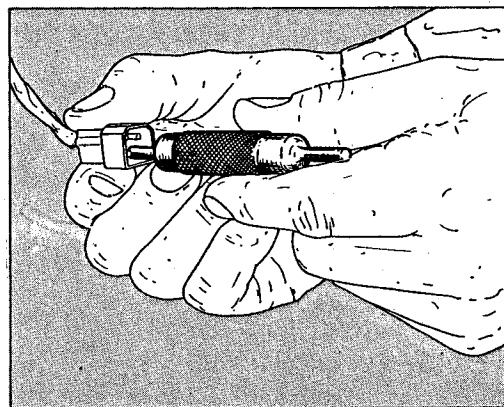
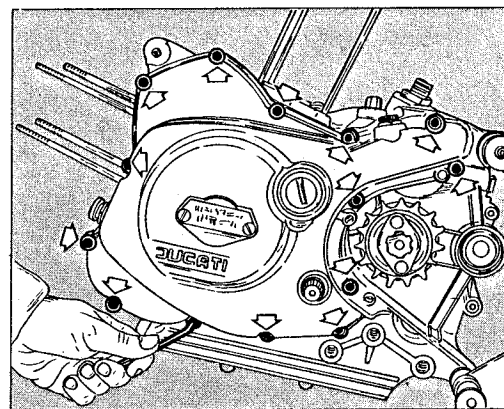
- Holding up piston, pull out pin with the help of another soft aluminum pin and a hammer.
- If piston pin is too tight, use a piston pin puller.

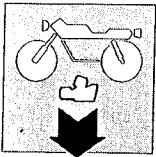
Note: Mark each piston up on its position (V or H) and an arrow to indicate direction.



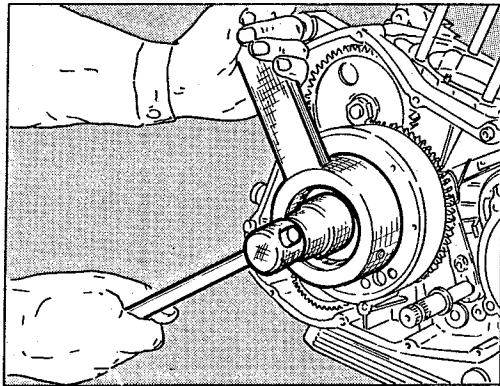


- To remove ignition side cover, loosen allen bolts and remove cover by using pullers 42416.
- Remove jacks from pick-up connector by using pullers ☆ 42413.
- Remove pick-up bolts and pick-up backing plate.
- Bend back tab on washer of alternator nut.

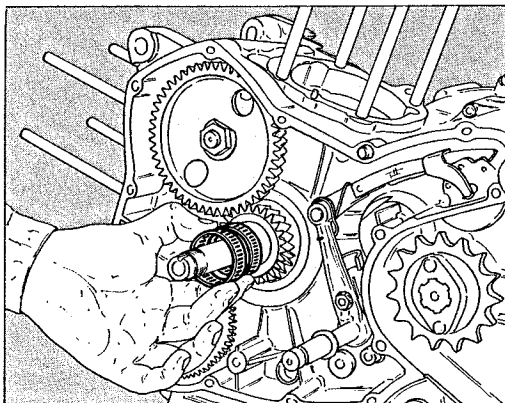
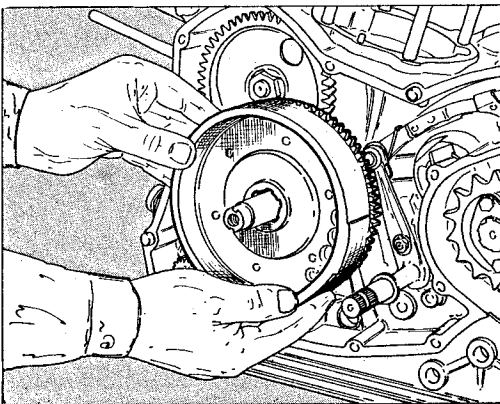
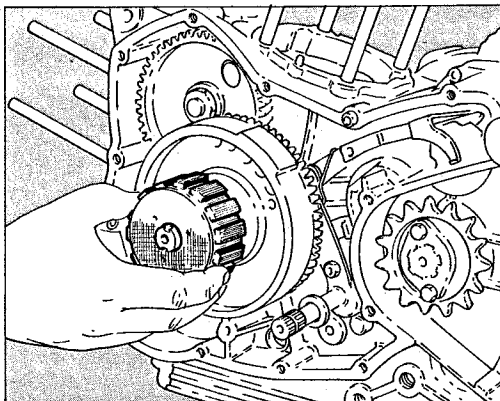


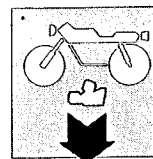


ENGINE DISASSEMBLY

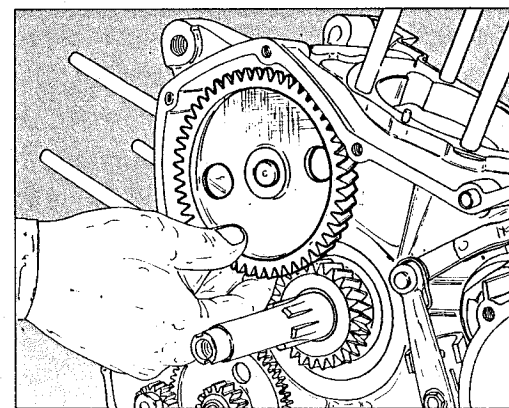
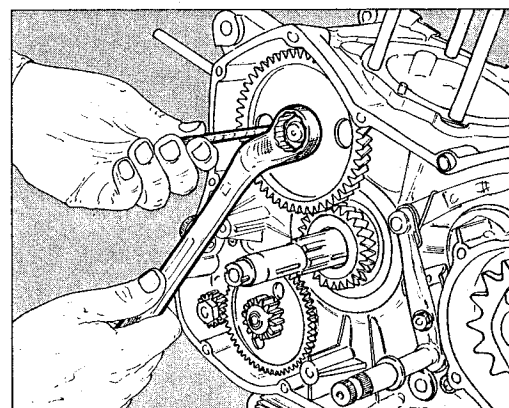
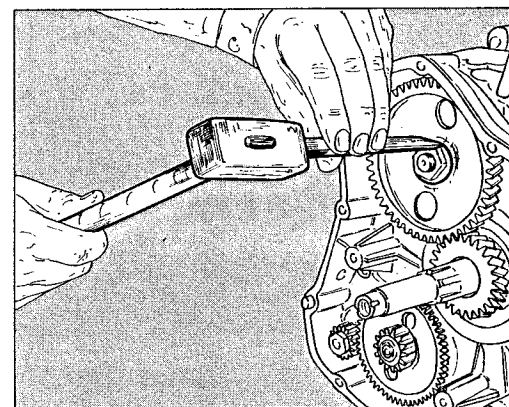
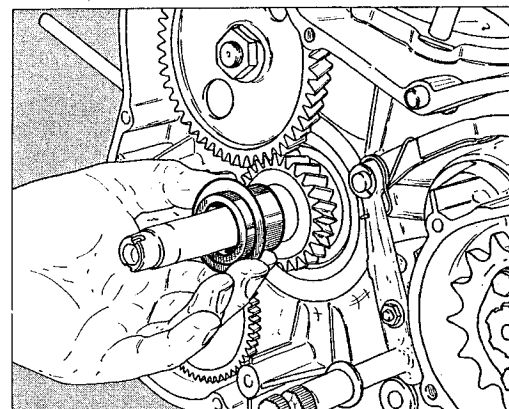


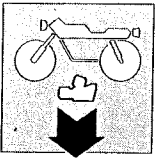
- Lock alternator by means of tool 42652 and remove nut.
- Remove washer, alternator and woodroof key.
- Remove ignition flywheel and idling gears.
- Remove the two needle bearings.



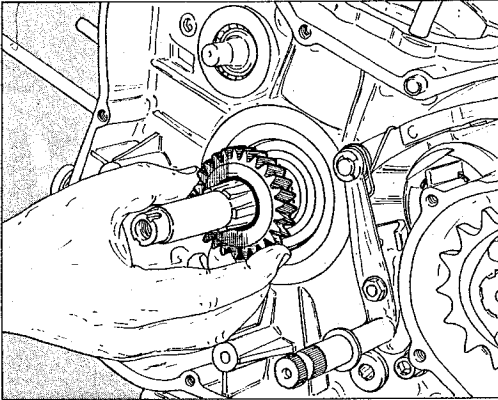


- Remove steel bushing and washer.
- Straighten up locking washer and remove nut from camshaft driving shaft by locking gear with a rod thru gear holes.
- Remove gear.

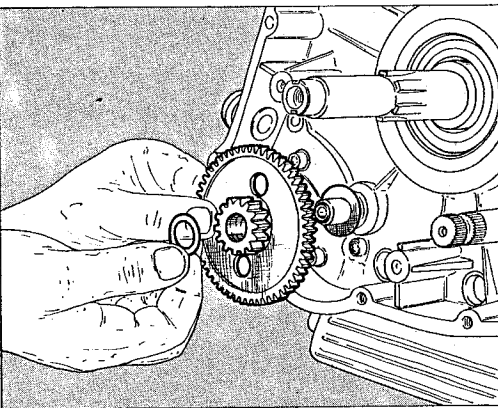
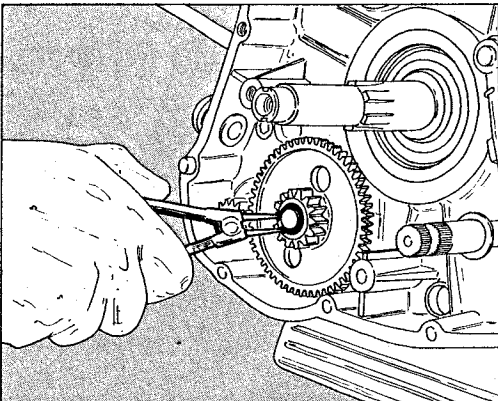


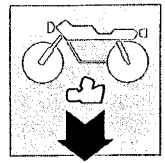


ENGINE DISASSEMBLY



- Remove camshaft driving pinion from crankshaft.
- Remove woodroof key from crankshaft.

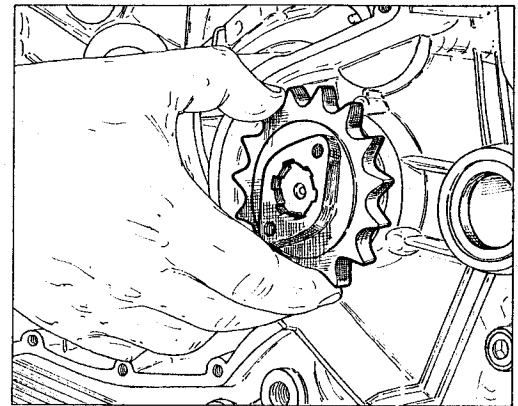
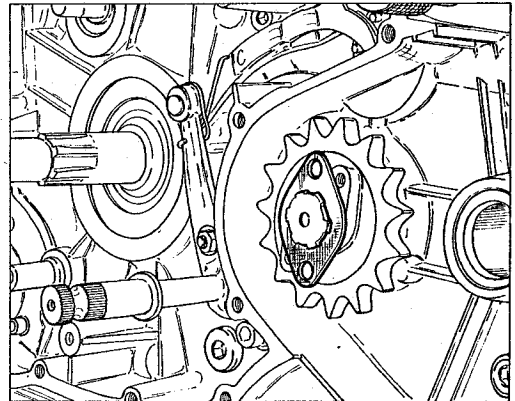
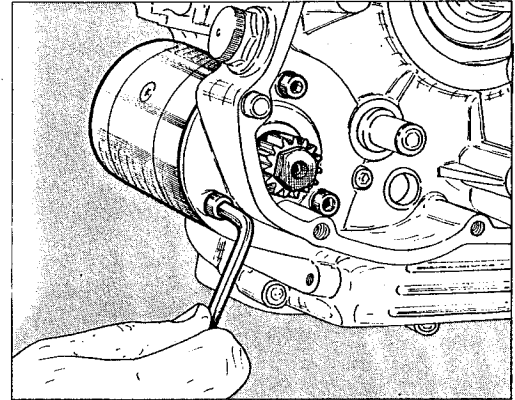


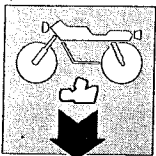


- Remove starter motor.

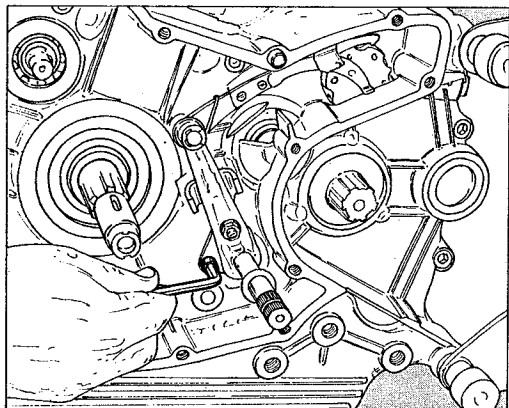
To remove countershaft sprocket.

- Remove bolts.
- Rotate holding plate until aligned with countershaft grooves and slide it out.
- Pull out countershaft sprocket.

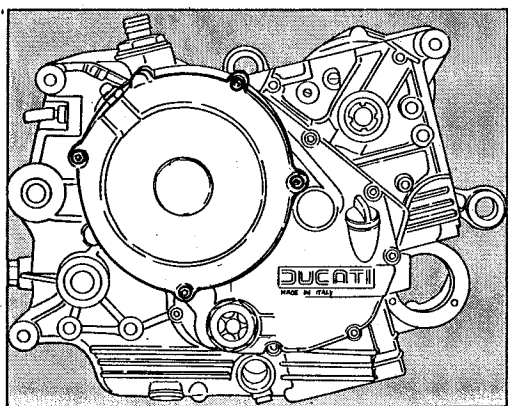
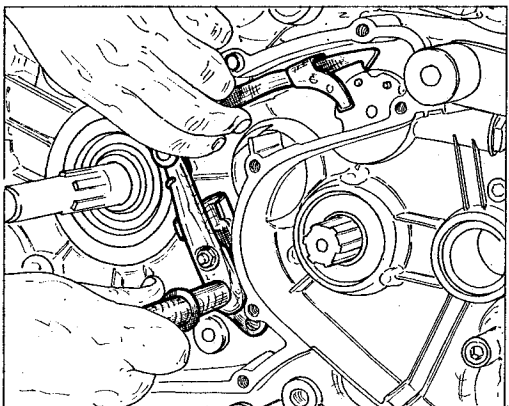




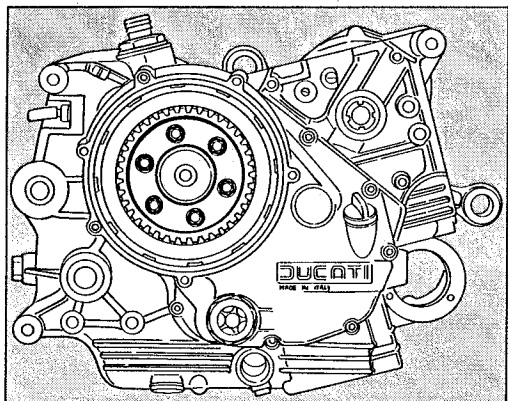
ENGINE DISASSEMBLY



- Remove bolts of shift mechanism support.
- Pull out shift mechanism assembly.

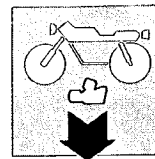


- Remove clutch side cover, tapping with plastic hammer if necessary.

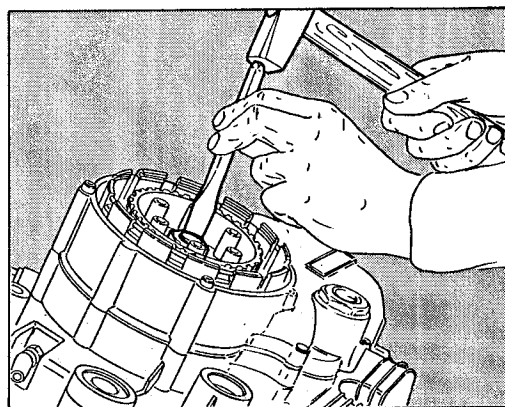
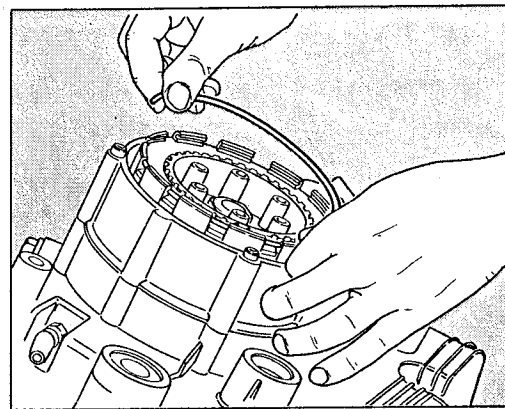


Remove:

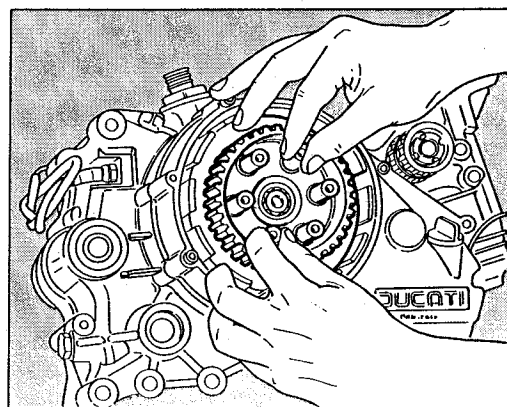
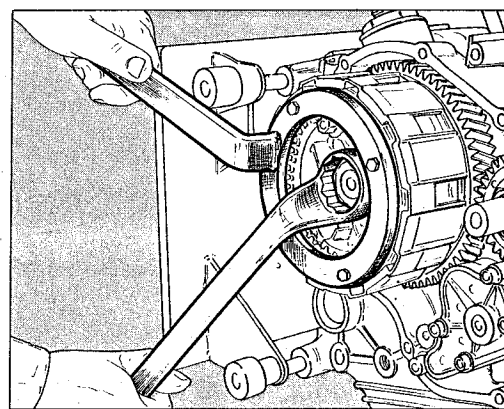
- Clutch spring bolts.
- Clutch springs.

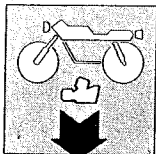


- Clutch plates retaining circlip.
- Clutch plates.

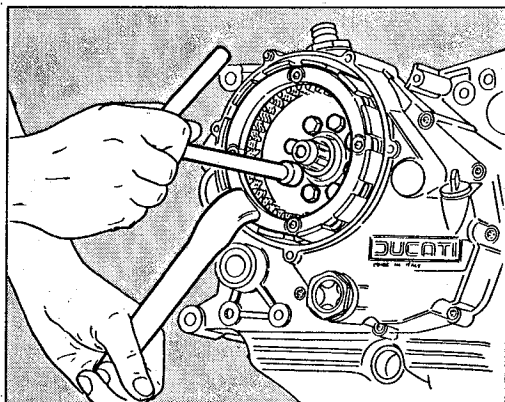


- Bend back tab of locking washer.
- Lock clutch hub by means of blocking tool ☆ 42403 and loosen nut.
- Remove:
Clutch hub nut.
Locking washer.
Clutch hub and inner spring plate.
Washer.

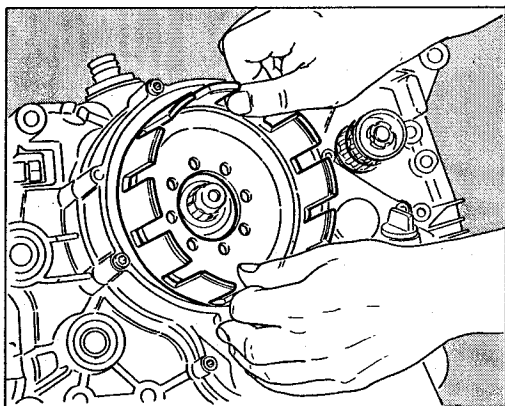




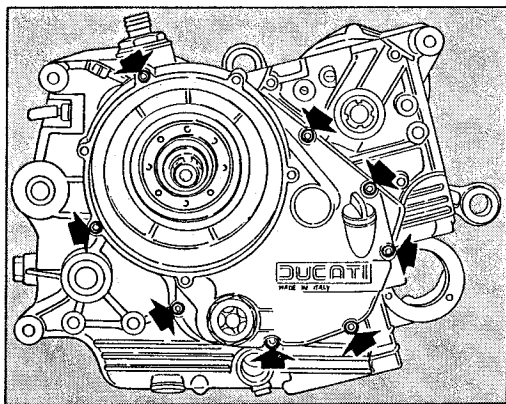
ENGINE DISASSEMBLY



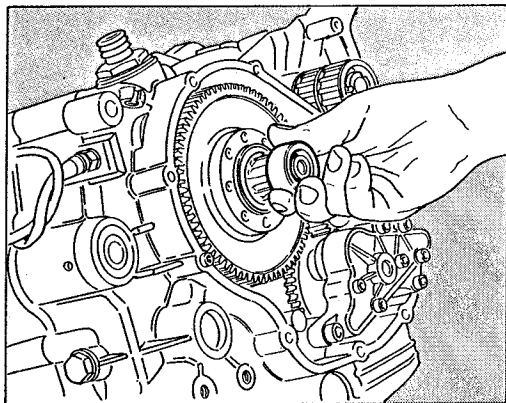
- Remove the 8 holding bolts and the clutch housing from primary gear.
Lock clutch housing by means of blocking tool ☆ 42403.
- Remove bushing.



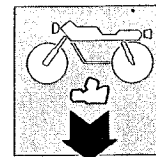
- Remove the clutch housing.



- Remove R.H. side cover.



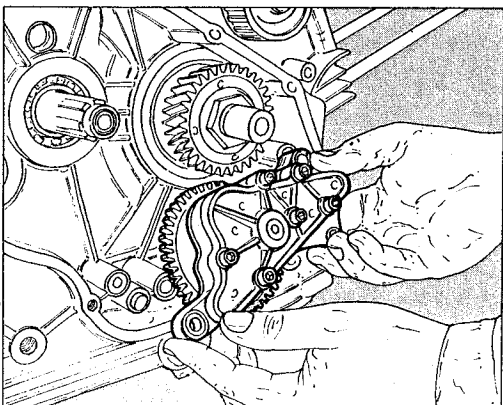
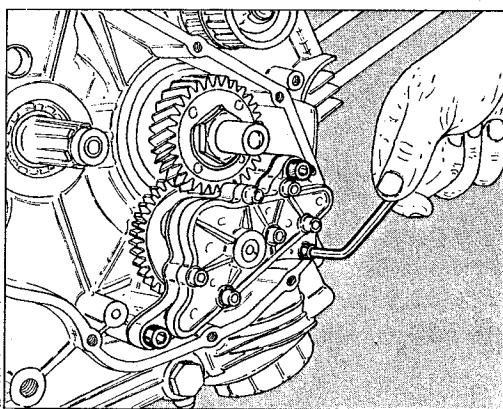
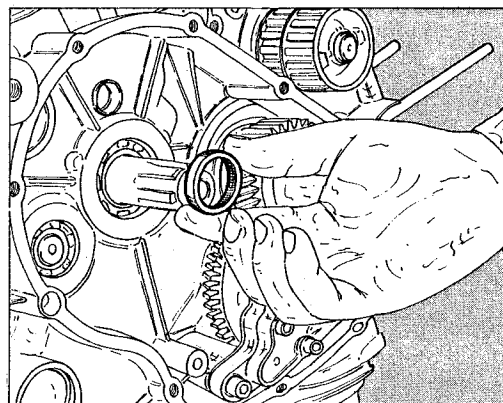
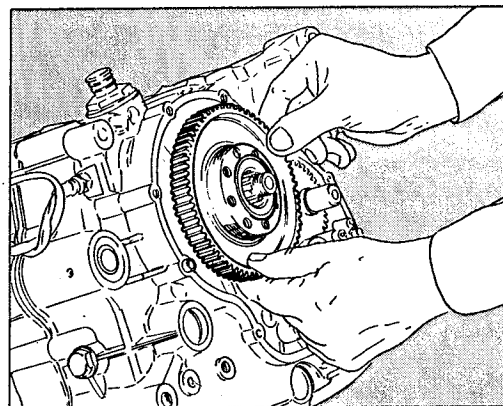
- Remove bushing.

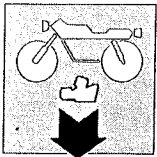


- Remove :
Primary gear.
Bushing.
Oil pump.

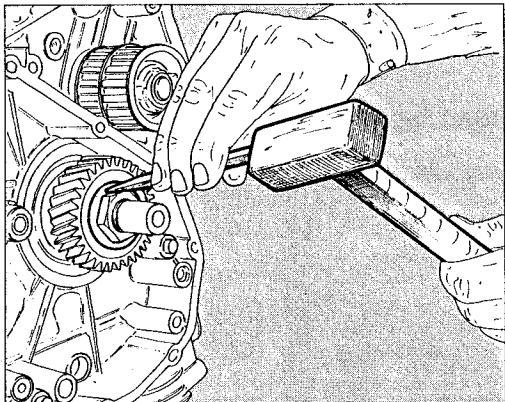
CAUTION

* When removing oil pump, watch out for bushings and rubber washers placed at rear of oil pump.





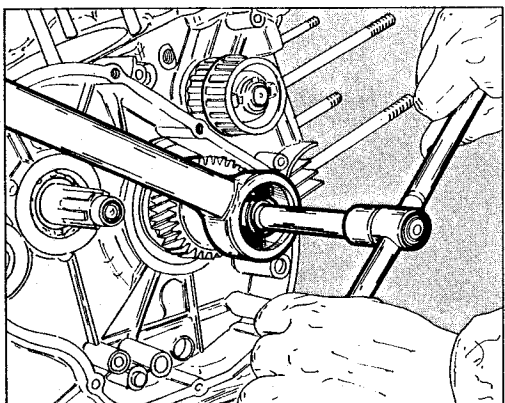
ENGINE DISASSEMBLY



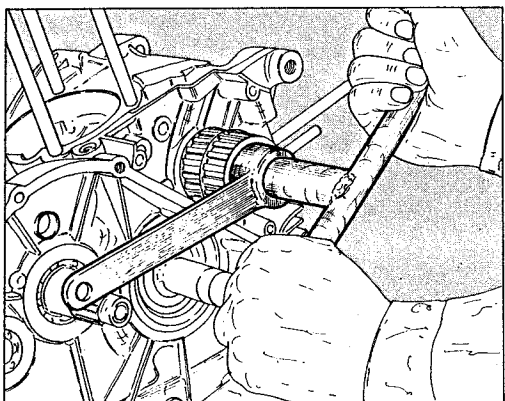
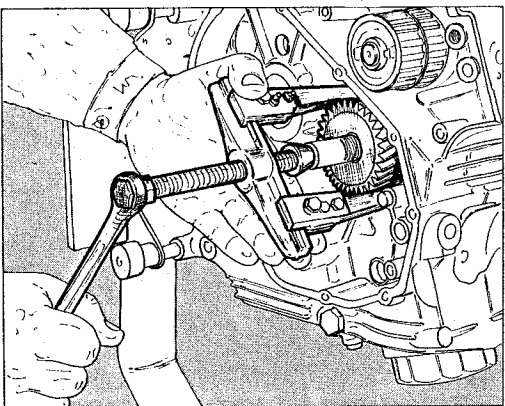
- Bend back tab on locking washer.
- Hold crankshaft pinion by means of tool ☆ 42409 and loosen up the nut.
- Remove pinion, use puller.

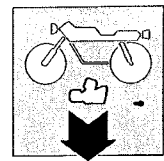
CAUTION

* Place an aluminum pad between crankshaft end and puller.

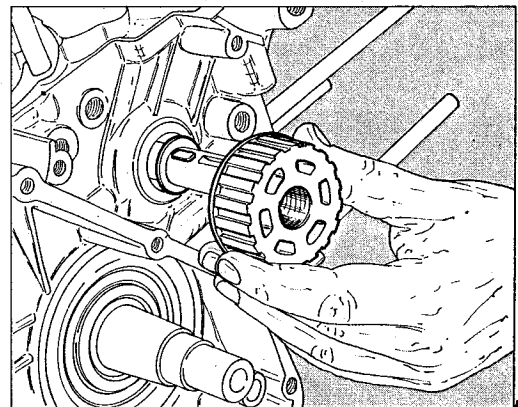
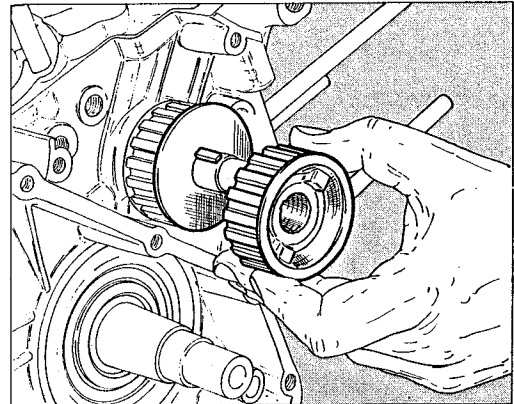


- Hold driving pullers by means of tool ☆ 42415 and use wrench ☆ 42414 to loosen nut.

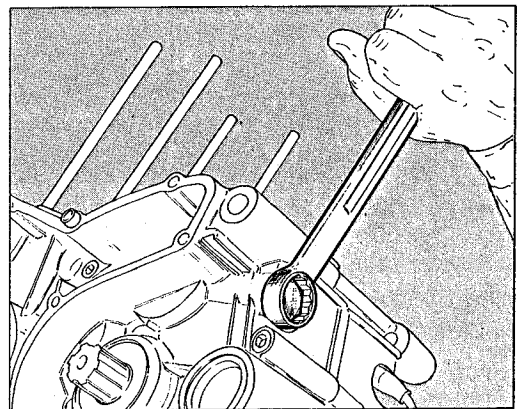




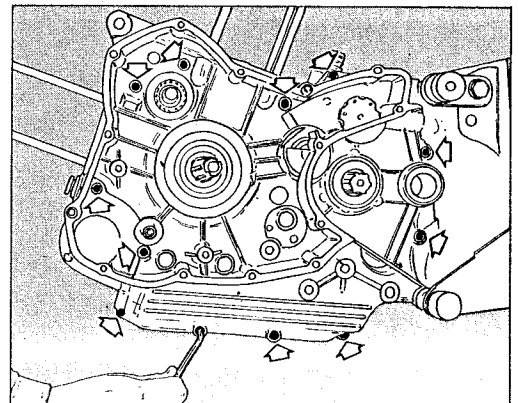
- Remove:
First pulley and woodroof key.
Second pulley and woodroof key.

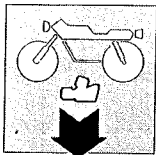


- Remove selector drum positioning pin assembly.

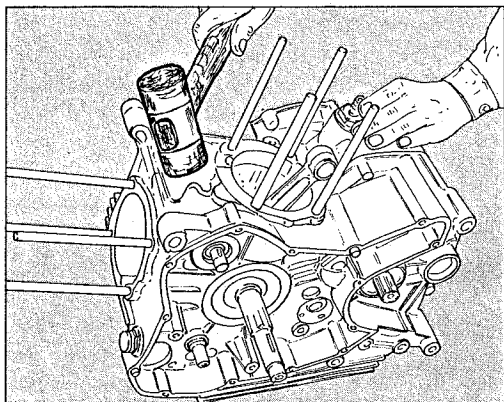


- Remove center crankcases bolts.

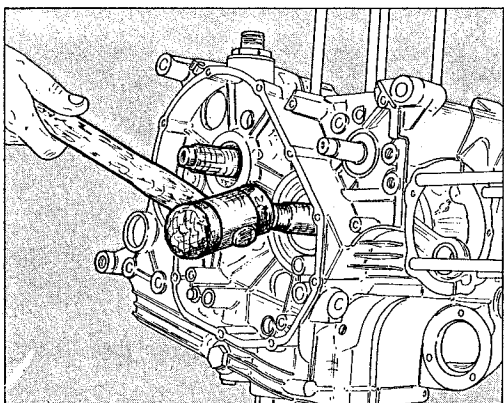




ENGINE DISASSEMBLY



- Slightly tap in the center cases junction with a plastic hammer.

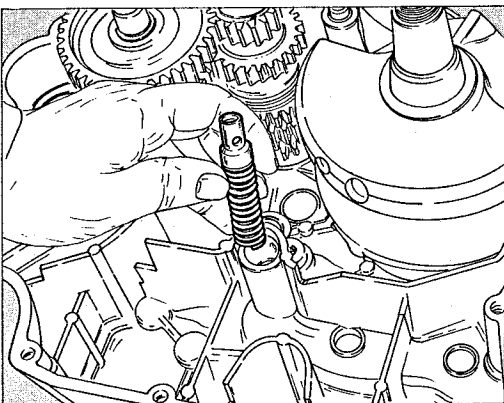
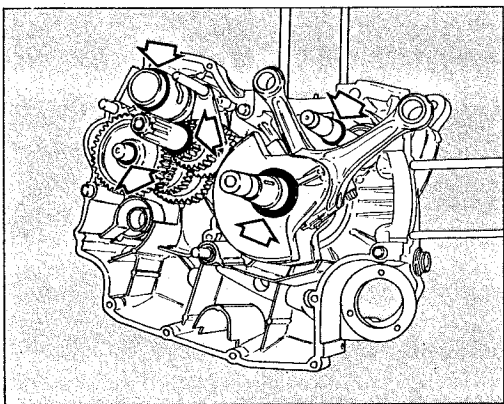


- Slightly tap, with a plastic hammer, crankshaft, and mainshaft until crankcase split is obtained.

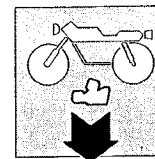
CAUTION

- * When crankcases split is obtained, watch carefully not to lose or misplace the shims from:
Crankshaft
Mainshaft
Countershaft
Selector drum

- * Do not, under any circumstances, use a screwdriver or other tool to pry the cases apart. This will ruin the cases.



- Remove oil pressure adjustment valve and spring.



- Remove camshaft driving shaft

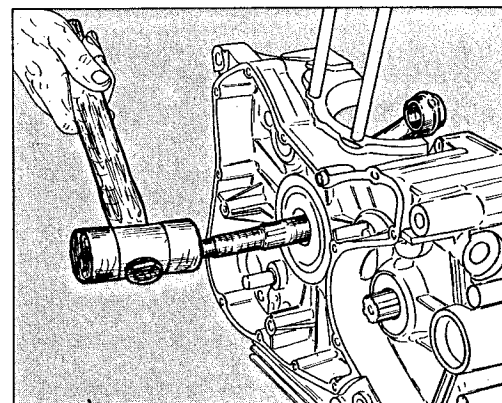
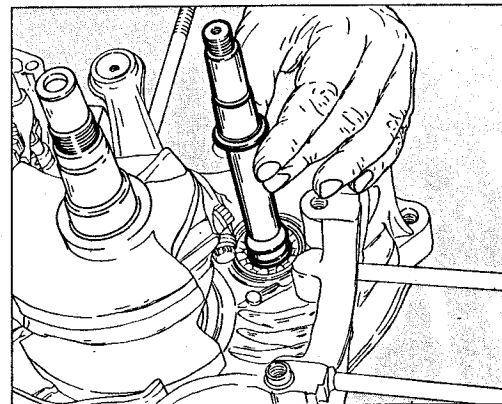
CAUTION

* Watch for the shims, do not loose or misplace.

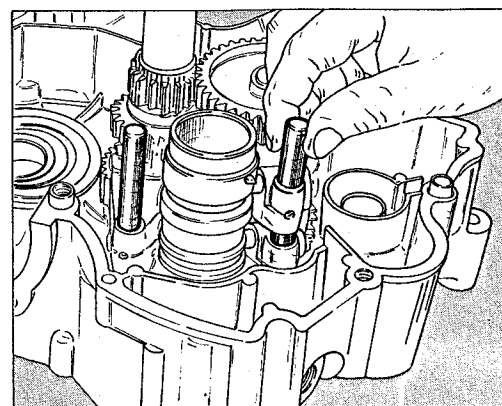
- Remove crankshaft by means of slightly tapping with a plastic hammer.

CAUTION

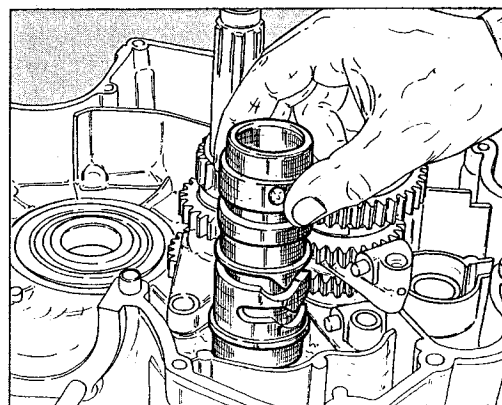
* Watch for shims, do not loose or misplace.

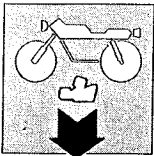


- Remove shift fork rods and move away shift forks from selector drum.

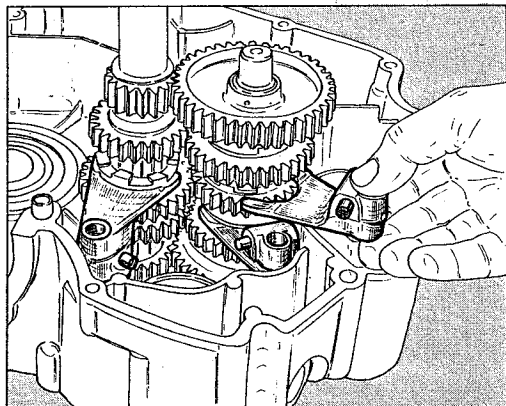


- Remove selector drum.

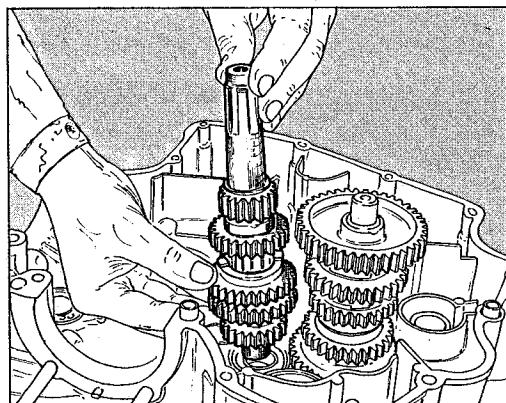




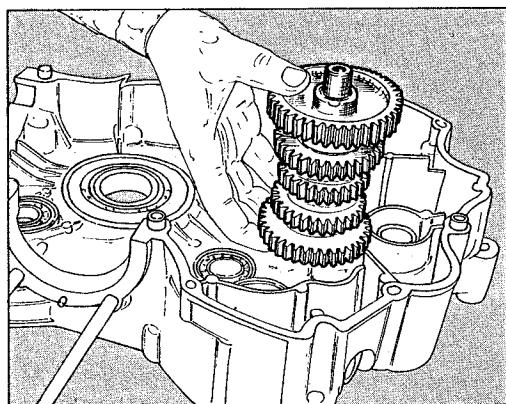
ENGINE DISASSEMBLY



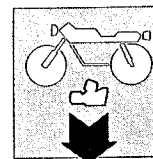
- Remove shift forks.



- Remove countershaft, watch for shims. Keep them in same position.



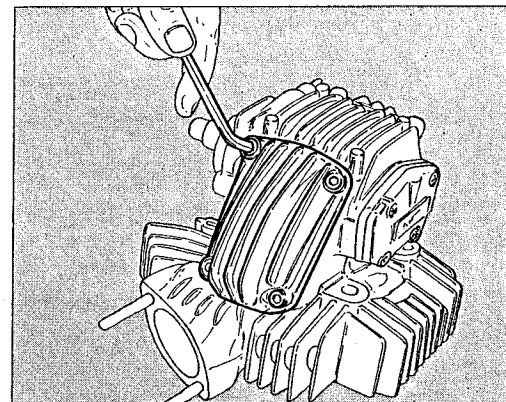
- Remove mainshaft, watch for shims. Keep them in same position.



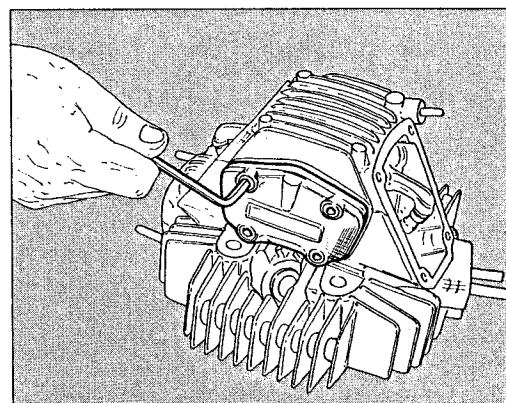
CAUTION

* When disassembling cylinder head components, mark them appropriately to be able to reassemble them in their previous position.

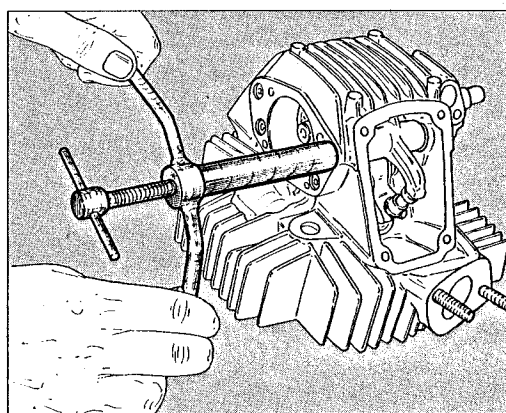
- Loosen bolts and remove valve covers.



- Loosen bolts and remove camshaft supporting cap.



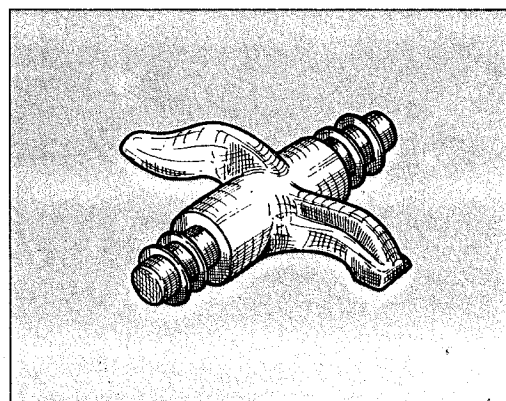
- Remove the opening rocker arm shafts by means of tool ☆ 42404.

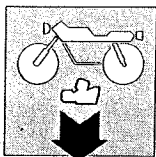


- Remove the rocker arms

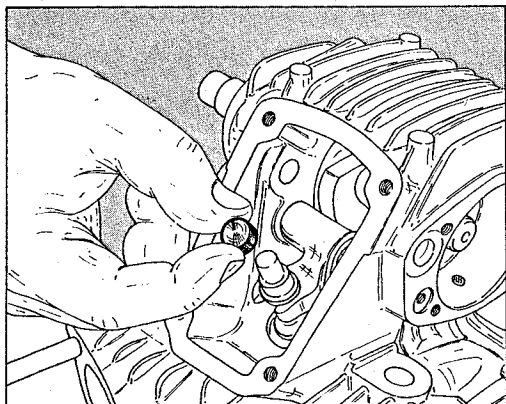
CAUTION

* When removing rocker arm shims, avoid damaging or scratching seat surface.

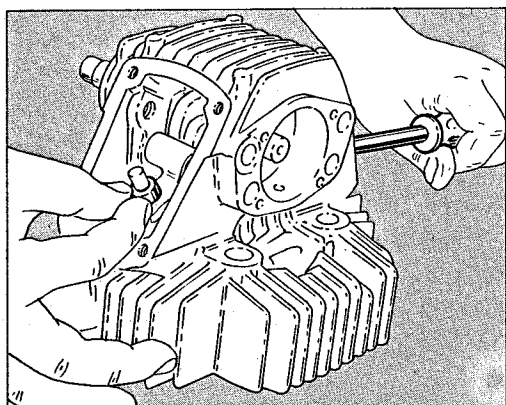




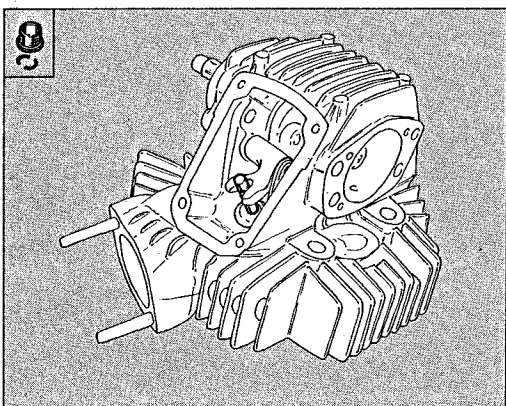
ENGINE DISASSEMBLY



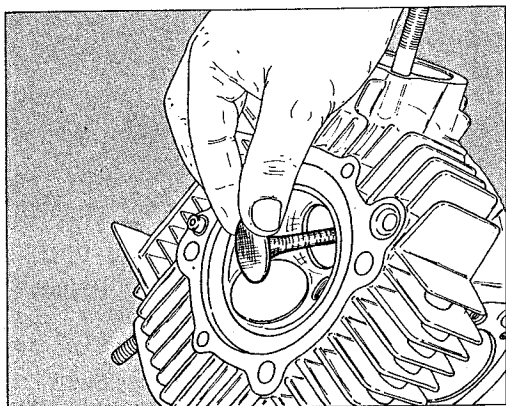
- Remove valve lifter.



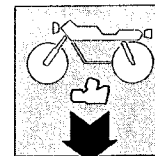
- Turn camshaft and with the aid of a screwdriver hold up the closing rocker arm.



- Remove the two closing cap. retainers.
- Remove cap.



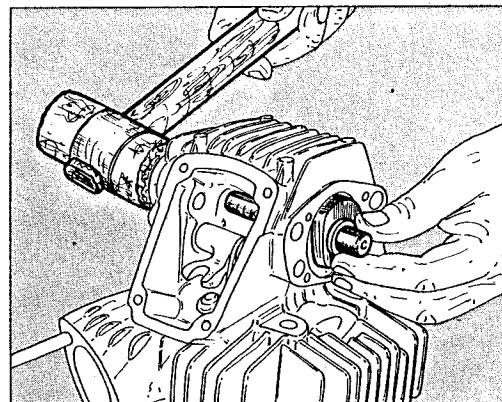
- Remove valves.



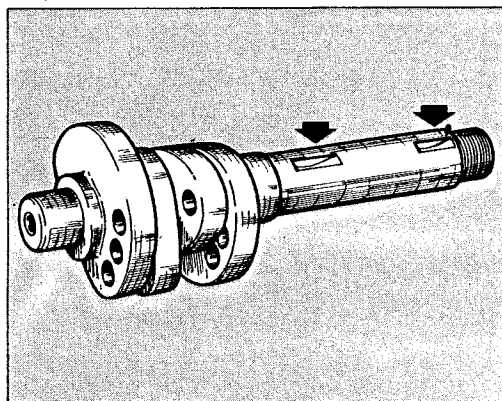
- Remove camshaft

CAUTION

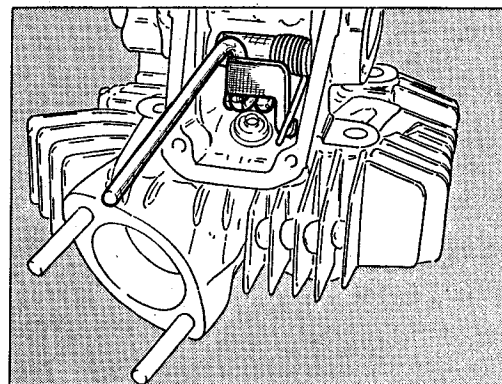
* Watch for shims.



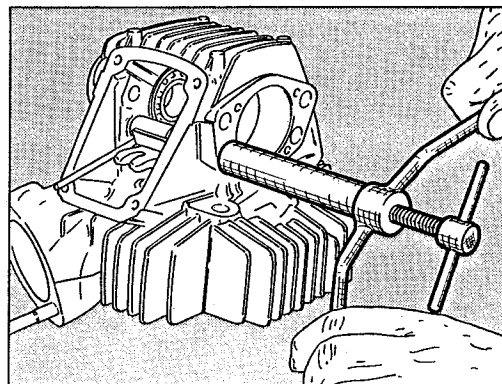
- Horizontal cylinder camshaft has two woodroof keys, while vertical cylinder has only one.

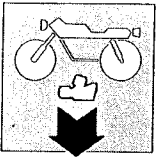


- Hold the end of closing rocker arm spring by means of tool ☆ 42410 and.

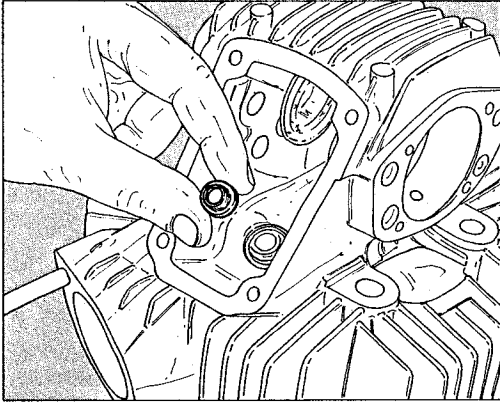


- Remove closing rocker arm shafts by means of tool ☆ 42404.





ENGINE DISASSEMBLY

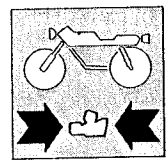


- Remove rocker arms

CAUTION

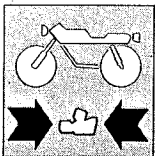
* Pay attention to side play shims. When reassembling must be in the same place unless play has to be corrected.

- Remove the valve guide oil seal.



- G.2 Washing parts
- G.2 Assemblies
- G.3 Measuring the cylinder
- G.4 Measuring the piston
- G.5 Piston-cylinder matching
- G.5 Piston pin
- G.5 Piston rings
- G.5 Piston ring-piston ring groove clearance
- G.6 Piston ring end gap
- G.6 Piston pin - Piston pin housing clearance
- G.6 Piston pin - Con-rod small end clearance
- G.7 Conrods
- G.7 Conrod small-end plain bearing replacement
- G.7 Rod bearing insert
- G.8 Crankshaft
- G.8 Crankshaft truing
- G.8 Grinding the crankshaft pin
- G.9 Matching conrod and conrod bearings
- G.10 Cylinder head
- G.10 Valve seat
- G.10 Valve guide
- G.10 Valves
- G.11 Valve-valve guide assembly
- G.11 Valve-valve seat assembly
- G.11 Replacing valve guide
- G.12 Replacing valve seats
- G.12 Rocker arms
- G.12 Rocker arm spring
- G.13 Rocker arm - Rocker arm shaft assembly
- G.13 Camshafts and bearings
- G.13 Pulleys - Belts - Tensioners
- G.13 Free wheel and starting mechanism
- G.14 Crankshaft assembly
- G.14 Crankcases
- G.14 Check of shaft
- G.15 Oil seal replacement
- G.15 Bearings
- G.16 Oil pump
- G.16 Clutch assembly
- G.17 Gearbox
- G.18 Shafts plain bearings
- G.19 Carburetor overhauling
- G.21 Float level
- G.21 Accelerating Pump fuel delivery

G



ENGINE OVERHAULING

Washing engine parts.

To remove carbon deposits and dirt, a high flash-point solvent is recommended to reduce fire danger. A commercial solvent commonly available in North America is stoddard solvent (generic name).

Note:

Always follow manufacturer and container directions regarding the use of any solvent.

WARNING

* Commercial solvents are flammable and can be explosive under certain conditions.

- * Do not smoke or allow flames or sparks in the area where the engine parts are washed.
- * Solvents may cause eye irritation. In case of contact, flush thoroughly with water and call a doctor.

Dry washed components thoroughly and dry with compressed air.

CAUTION

* Do not use compressed air to spin the bearings dry. This causes damage to the bearing surfaces.

Do not wash oil seals and other rubber components with solvent, as chemical action will damage rubber characteristics and replacement will be needed.

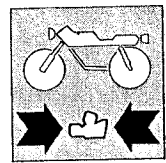
Note : All gaskets, seals and O-rings should be replaced when an engine is overhauled. All gasket surfaces, oil seal lips and O-rings must be cleaned.

Assemblies

For a good and efficient engine operation, it is essential that all assemblies are within the tolerances prescribed by the Manufacturer.

If tolerances are too close, damaging seizures may occur as soon as heat builds up in engine.

If tolerances are too big, vibrations may appear, mechanical noise increase and moving parts wear accelerate.

**Measuring the cylinder.**

Check that cylinder walls are perfectly smooth. Measure cylinder bore at three different heights and two different directions, at 90°, to obtain taper and ovalization values.

Max. taper = Max bore - min. bore at different heights = 0.05 mm (0.002 in).

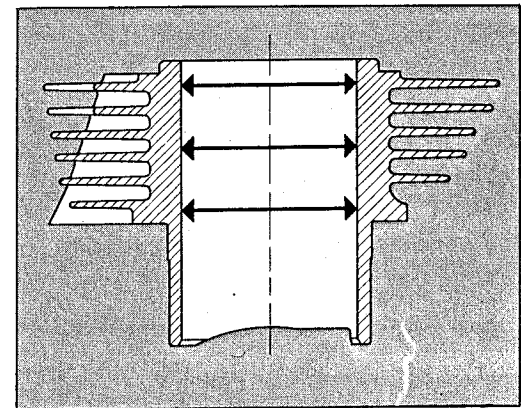
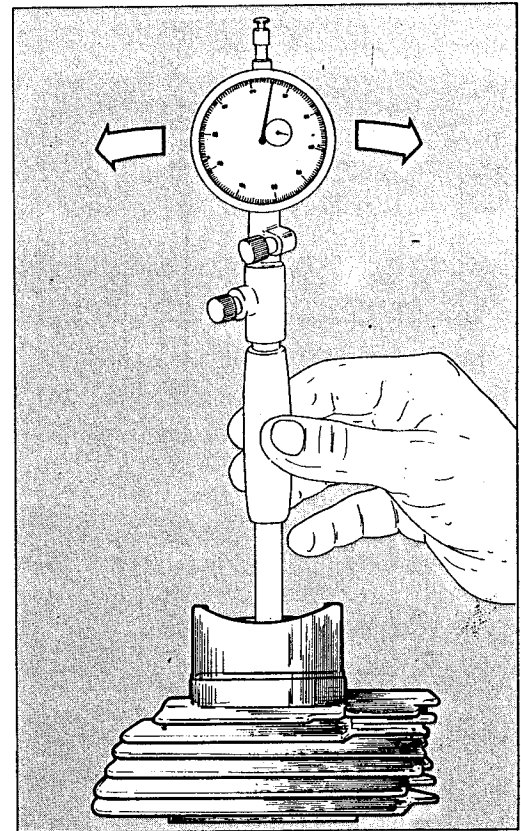
Max. out of round = Max. bore - min. bore at same height = 0.05 mm (0.002 in).

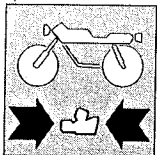
If cylinder has suffered damage or excessive wear, the cylinder must be replaced.

The Patented GILNISIL coating has exceptional antifriction and antiwear properties but as most electrolytical coatings cannot be rebored.

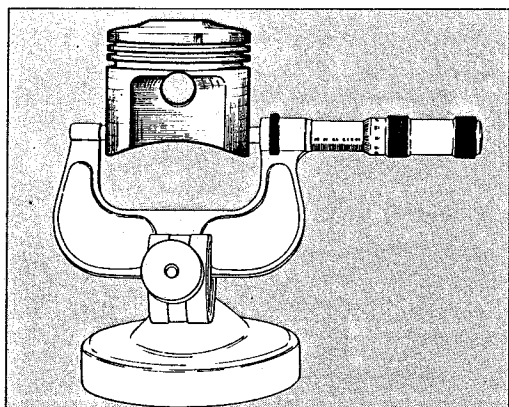
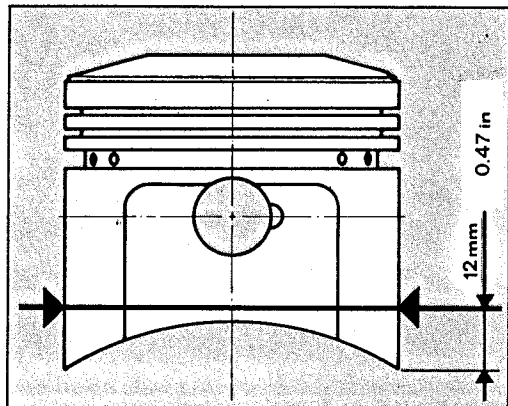
All cylinders are marked with a letter indicating the measurement family they belong to.

Piston-cylinder assemblies must always be performed with parts of same family.

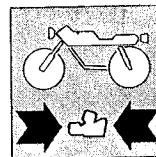




ENGINE OVERHAULING



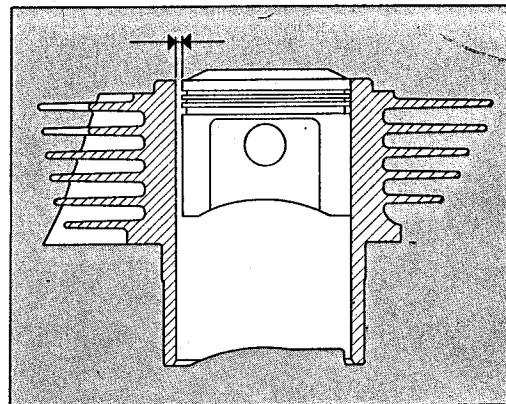
- Where carbon deposit is thick and hard, it is advisable to scrape carbon off. Use a putty knife or ground tip on an old file. Use care to keep from scraping into aluminum of piston.
- Place the pistons in GUNK HYDROSEAL or other carbon or gum dissolving agent until deposits are soft.
- Scrub piston dome to remove deposits.
- Wash piston in solvent and blow dry with compressed air.
- Clean piston ring grooves with a piece of compression ring ground to a chisel shape.
- Check piston diameter at 12 mm. (0.47 in) from the bottom of piston skirt using a micrometer.



Piston-cylinder matching

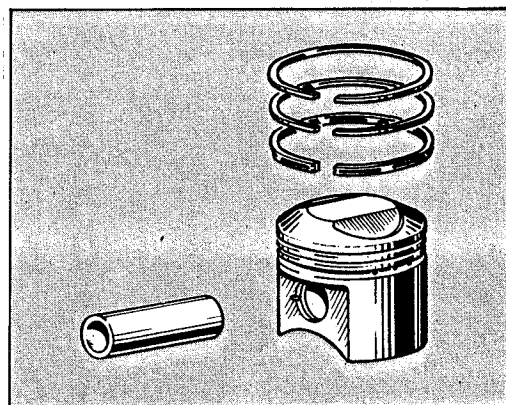
Standard clearance: 0.02÷0.04 mm (0.0008~0.0016 in)

Service limit clearance: 0.14 mm (0.0055 in)



Piston pin

- Examine piston pin to see that it is not pitted or scored.
- If piston pin replacement is necessary, also replace the piston pin bushing.



Piston rings

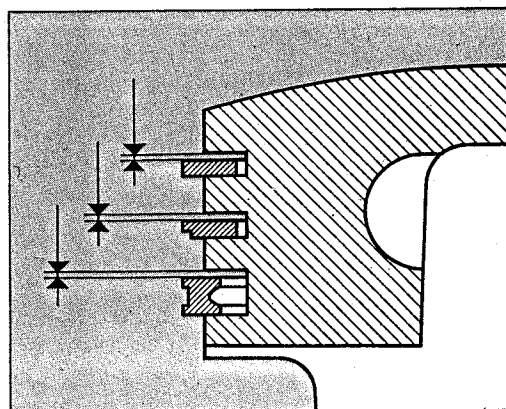
Examine piston rings to see that are not scored or damaged.

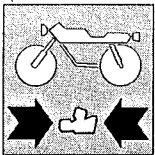
Piston ring - Piston ring groove clearance

Standard clearance:

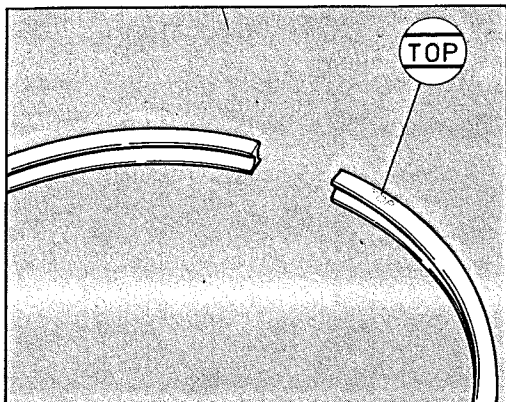
0.020~0.052 mm
(0.0008~0.0020 in)

Service limit clearance: 0.12 (0.047 in)





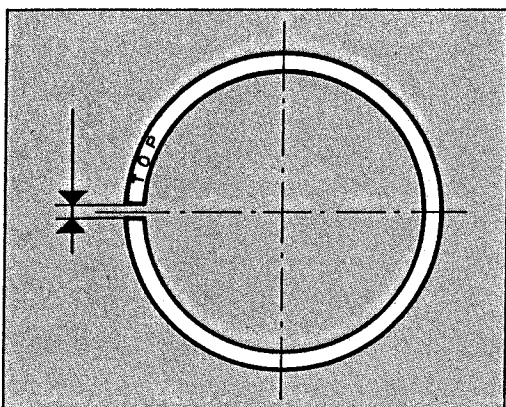
ENGINE OVERHAULING



Note: Be sure to install the rings so that the mark "TOP" is located on the top side of the piston.

Piston ring end gap.

- Position piston ring inside of the bottom end of the cylinder.
- Push the ring with the piston crown no more than 10 mm. (0.4 in) inside the cylinder.
- Use feeler gauge to check piston ring gap.



Top Piston ring:

Standard: 0.25 ~ 0.40 mm (0.0098 ~ 0.0157 in)

Service limit: 1.20 mm (0.047 in)

Middle Piston ring:

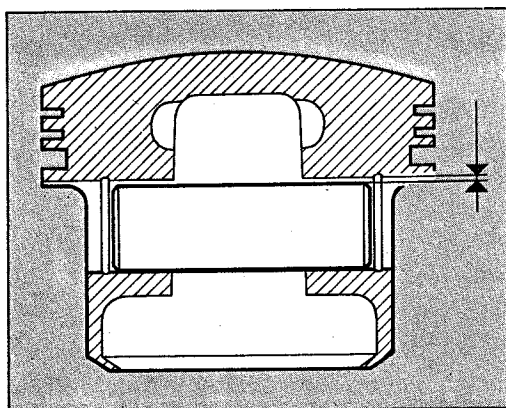
Standard: 0.25 ~ 0.40 mm (0.0098 ~ 0.0157 in)

Service limit: 1.20 mm (0.047 in)

Bottom Piston ring:

Standard: 0.20 ~ 0.35 mm (0.0079 ~ 0.0138 in)

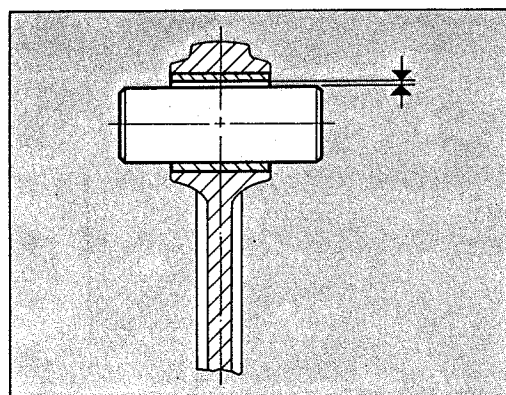
Service limit: 1.20 mm (0.047 in)



Piston pin - Piston pin housing clearance.

Standard clearance: 0.002 ~ 0.013 mm (0.00007 ~ 0.00051 in).

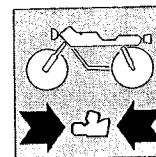
Service limit: 0.05 mm (0.0020 in)



Piston pin - Con-rod small end bushing clearance.

Standard clearance: 0.006 ~ 0.029 mm (0.00023 ~ 0.00114 in)

Service limit: 0.05 mm (0.0020 in)



Conrods.

The conrod small end bushing must be in good conditions and firmly set in its housing.

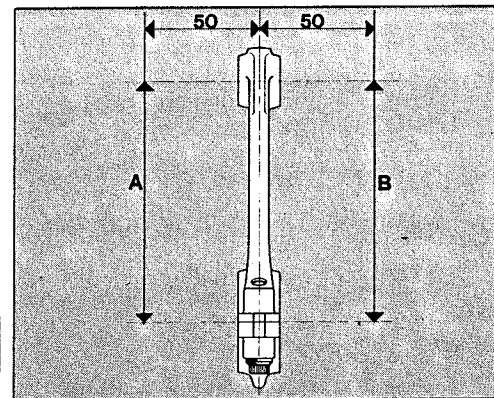
Remove the connecting rod big end bearing inserts. Select an arbor of the same diameter as the connecting rod big end and of optional length, and insert it through the big end of the connecting rod.

Select an arbor of the same diameter as the piston pin and 100 mm. (3.93 in) long., and insert it through the small end of the connecting rod bushing.

On a surface plate, set the big-end arbor on V blocks so that the connecting rod is perpendicular to the surface plate. Using a height gauge or dial gauge, measure the difference in the height of the small-end arbor above the surface plate.

If the measurement exceeds the service limit, replace the connecting rod.

Service limit: 0.05 mm (0.0020 in).



Connecting rod small-end plain bearing replacement.

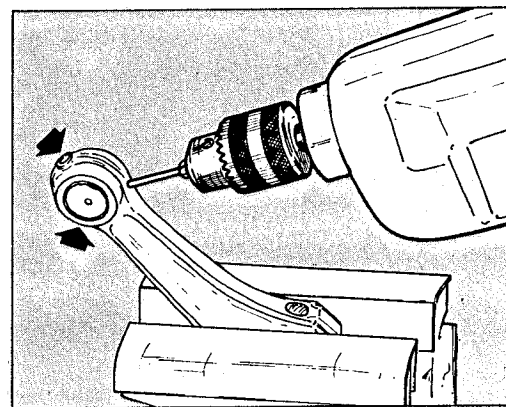
To replace small-end bearing use a Piston pin bushing tool and a hydraulic press.

Mounting interference between bushing and connecting rod small end must be:

0.052 ~ 0.095 mm (0.0020 ~ 0.0037 in)

Drill an oil hole in bushing aligned with oil hole in rod.

Rebore bushing to 18.006 ~ 18.024 mm (0.7088 ~ 0.7096 in)

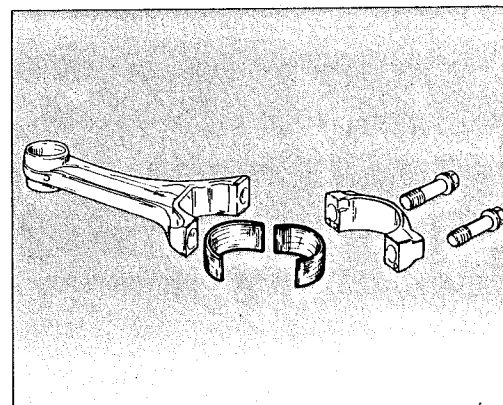


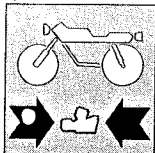
Connecting rod bearing insert.

It is a good practice to replace connecting rod bearing inserts at each engine overhaul.

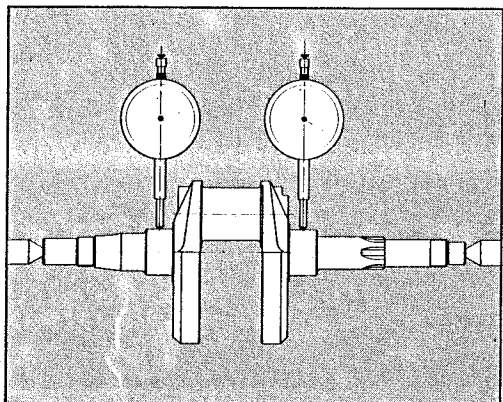
Replacement bearing inserts are supplied ready for mounting and do not need to be adjusted with scrapers or emery cloth.

If crankshaft pin has been ground, use bearing inserts (supplied as spare parts) with internal diameter reduced of 0.25 mm (0.0098 in) or 0.50 mm (0.0197 in).





ENGINE OVERHAULING



Crankshaft.

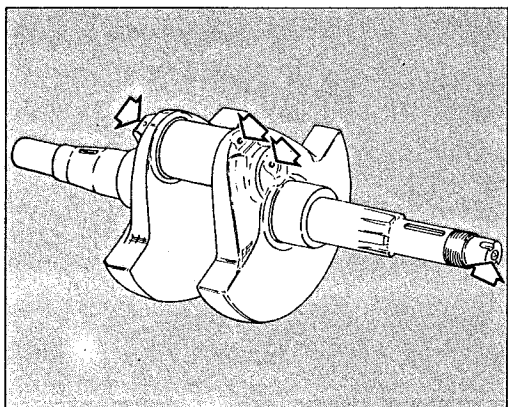
- Examine crankshaft pin to see that it is not pitted, scored, indented.
- With the aid of a micrometer check the ovalization (max. admitted 0.01 mm or 0.0004 in) and taper (max. admitted 0.01 mm or 0.0004 in).

Crankshaft truing.

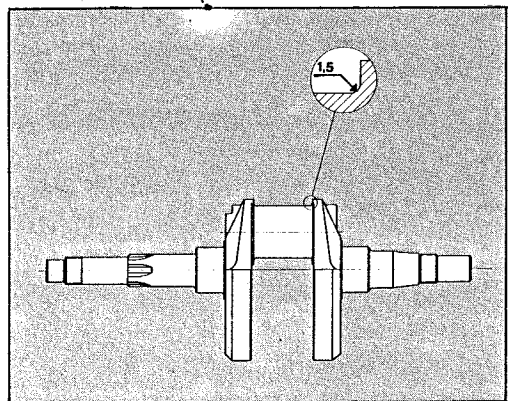
- Install Crankshaft in Flywheel Truing Stand.
- Place dial gauges in the center of main bearings housing.
- Turn flywheels slowly and observe the movement of indicator pointers.

Max. admitted difference between the two readings: 0.02 mm or 0.0008 in.

Note * When installing crankshaft in truing stand, adjust so centers are snug. Wheels must turn freely but shafts may not be loose in centers. If crankshaft is loose or tight, indicators will not read accurately.



- Remove the screw-on caps and carefully clean the lubrication channels.
- Place few drops of Loctite 242 on the plug that closes the inner hole of the crank pin and place back the plug.
- The other three threaded caps are already fitted with an insert of self-locking material.



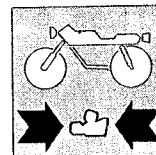
Grinding the Crank pin

- If crank pin is damaged or worn out, grinding must be performed at a specialised workshop.
- Original crank pin diameter is:
40.008 ~ 40.020 mm or 1.5751 ~ 1.5755 in.
- The diameter can be reduced by grinding:
0.25 mm (0.0098 in) or 0.50 mm (0.0197 in).

Note: * It is absolutely necessary that crank pin - flywheel radius be a maximum of 1.5 mm (0.059 in).

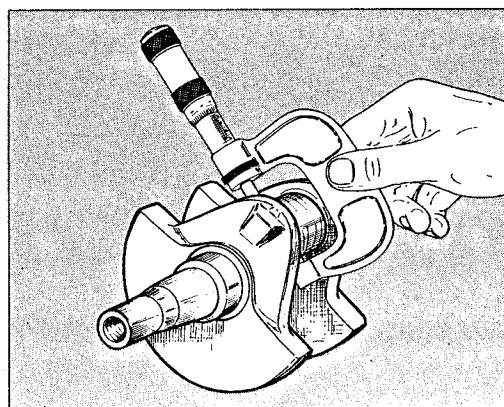
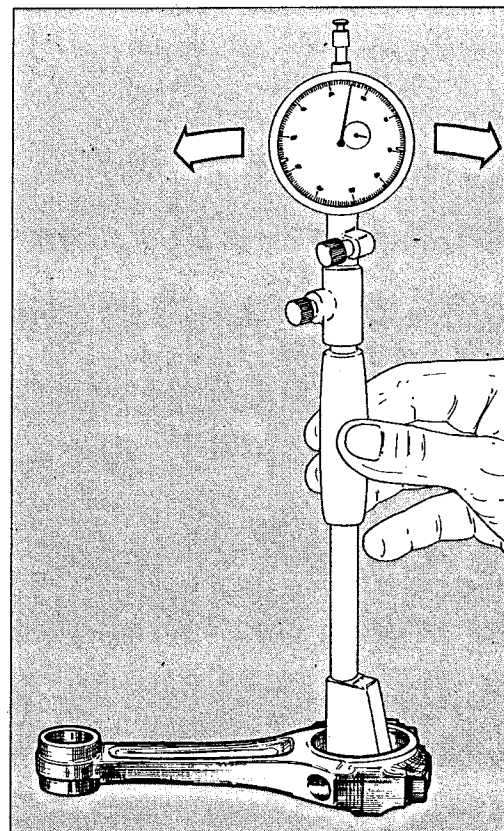
CAUTION

* To reconstitute crank pin surface characteristics, grinding must be followed by heat-treating (sulphurnitriding at 550°C).



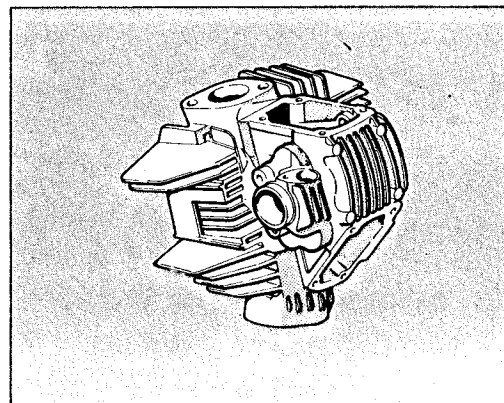
Connecting rod - connecting rod insert bearings matching.

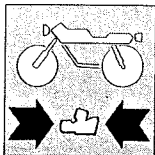
- Mount insert bearings in connecting rod big end.
- Tight bolts up to 63.7 Nm (6.5 Kgm or 47.01 lb/ft).
- Measure con rod big end diameter.
- Measure crank pin diameter.
- Tolerance must be:
0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in).



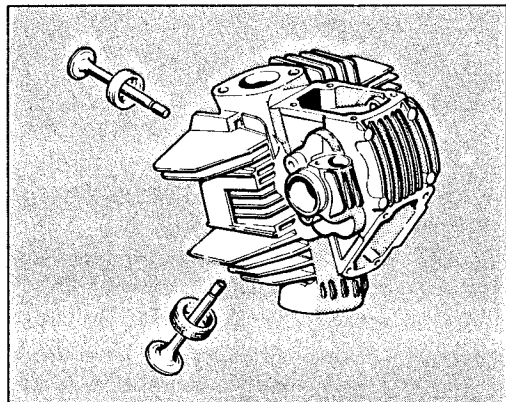
Cylinder head.

- Remove carbon deposits from combustion chamber.
Check for cracks and make sure that there are no dents or damage of any kind on the sealing surfaces.
- Cylinder head seatings must be perfectly flat.
- Check spark plug thread, must be in good conditions.





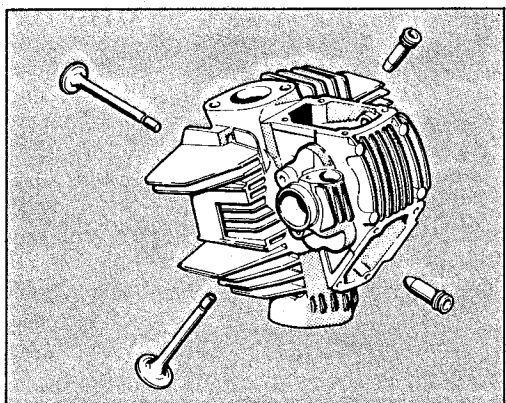
ENGINE OVERHAULING



Valve seats.

- Check that valve seats are not recessed pitted or cracked.
- If valve seat shows damage, it must be milled using 45° cutters.

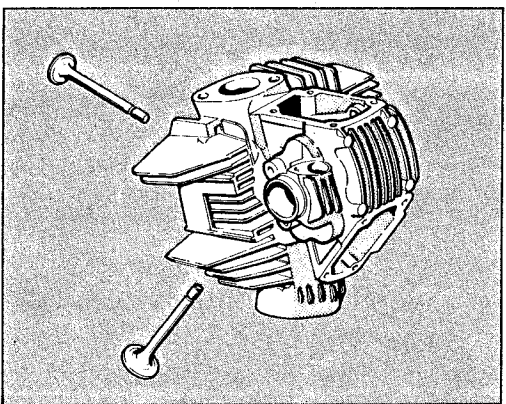
Note: * If valve seat needs to be milled, valves must be ground to match.



Valve guides.

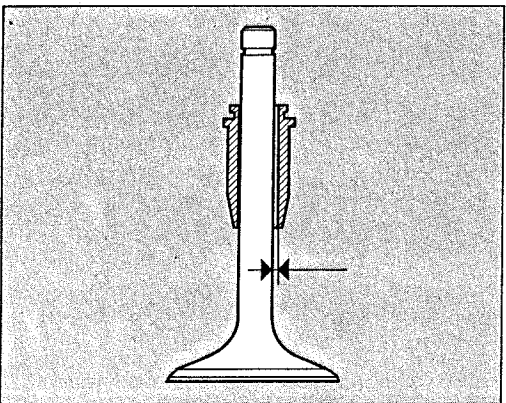
- Check visually valve guides and replace if necessary.

Note: * When replacing valve guides, replacing valves is necessary.



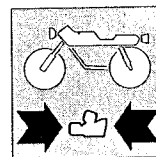
Valves.

- Check that the stem and contact surface with valve seat are in good condition.
No pitting, cracks, deformations or signs of wear are permitted.
- Make sure that the stem is perfectly straight.



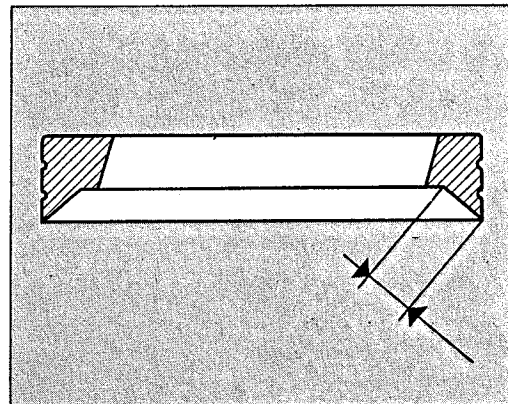
Valve - Valve guide assembly.

- Clearances are:
0.01 ~ 0.03 mm (0.0004 ~ 0.0012 in)
- Service limit: 0.08 mm (0.0032 in).

**Valve - Valve seat assembly.**

- Check that contact surface between valve and seat is 1.4 ~ 1.6 mm (0.0551 ~ 0.0629 in).
- If measured dimensions are off the limits, grind the valve and seat.

Note: * To check the contact surface, use Prussian blue.

**Replacing valve guide.**

Replacing valve guides, if necessary, must be done before valve seat is ground since the valve stem hole in valve guide is the basis from which all seat grinding is done.

Valve stem - valve guide clearances are listed in G.21. If valve stems and/or guides are worn beyond service wear limits, new parts must be installed.

To replace valve guides, act as follows:

1. - Heat up slowly and evenly the cylinder head till reaching 150° ~ 160°C (302° ~ 320°F).
2. - Tap guides from combustion chamber towards outside using drift pin shown.
3. - Let cylinder head and valve guides cool down to room temperature.
4. - Inspect the inside diameter where the valve guide fits in the head and the seat that the shoulder of the valve guide abuts. These must be free of scores, burrs and foreign material. If necessary, ream the inside diameter to the next oversize. The interference, measured cold, between the valve guide and the seat must be 0.04 ~ 0.05 mm (0.0016 ~ 0.0020 in).

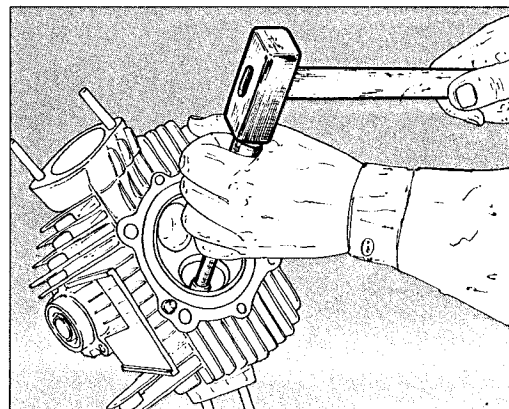
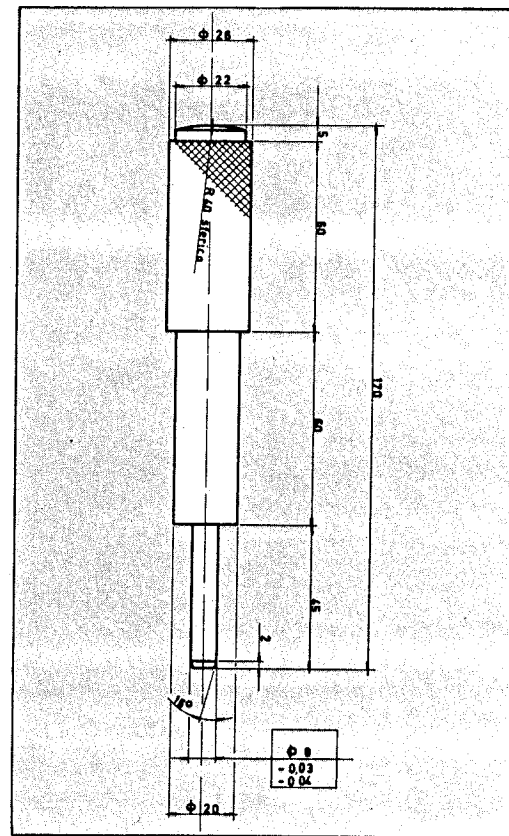
Note: * Over size outside valve guide diameter are available in the following sizes:

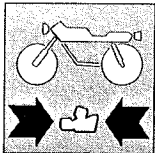
0.03 mm (0.0012 in)
0.06 mm (0.0024 in)
0.09 mm (0.0035 in)

5. - Heat up slowly and evenly the cylinder head till until 150° ~ 166°C (302° ~ 320°F) are reached.
6. - Lubricate the outside of the new valve guide with white lead or anti-seize compound. Using the drift pin quickly and carefully install the new guide. Make sure it is driven fully home.
7. - Allow the cylinder head to slowly cool.

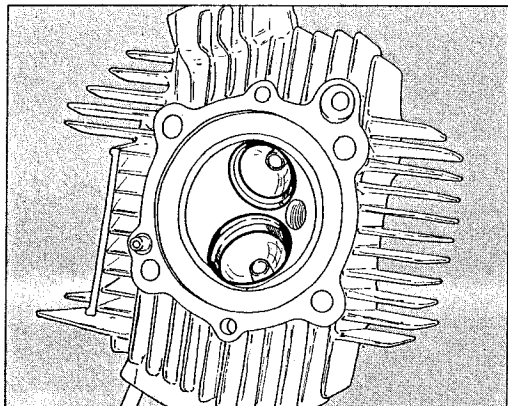
WARNING

* Avoid to touch cylinder head with bare hands.





ENGINE OVERHAULING



Replacing valve seat.

If valve seat replacement is required, act as follows:

1. - Mill the old valve seats.

CAUTION

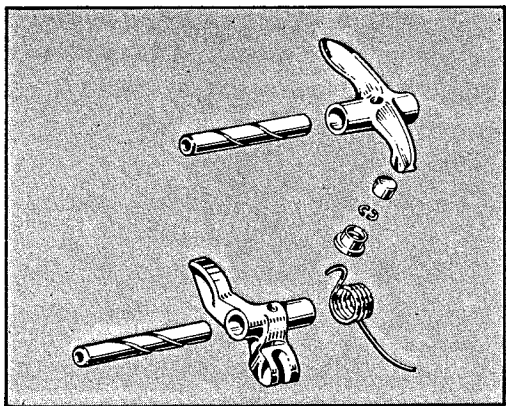
* Be carefull not to damage the head.

2. - Check valve seat housing on cylinder head and choose the right oversize seat valve.

Assembly interference: 0.11 ~ 0.16 mm (0.0043 ~ 0.0063 in).

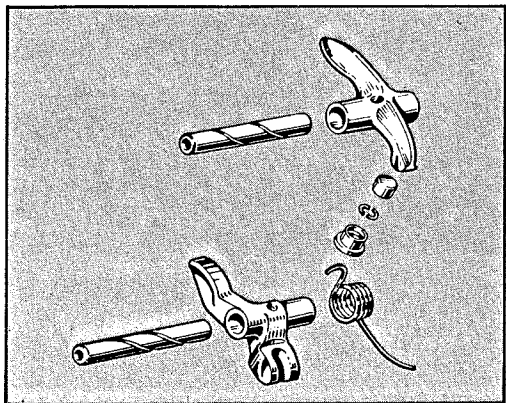
Note: * Oversized seat valves, in the outside diameter, of 0.03 mm (0.0012 in) are supplied as spare parts.

3. - Evenly heat up cylinder head to a maximum of 180° ~ 200°C (356 ~ 392°F).
4. - Introduce new valve seats.
5. - Let the cylinder head cool down to room temperature.
6. - Grind the seats and grind the valves.



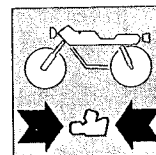
Rocker arms.

- Check that the working areas are in perfect conditions, with no signs of wear, grooving or chrome coating damage or peeling.
- Check the condition of rocker arm bore and shaft.
- Check that the working areas of the adjusters and return caps of the valves are perfectly flat and that there are not signs of wear.

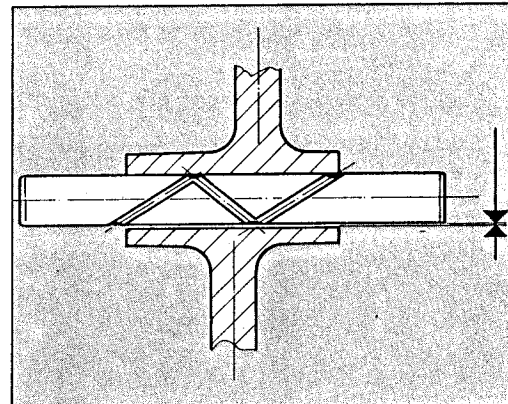


Rocker arm spring.

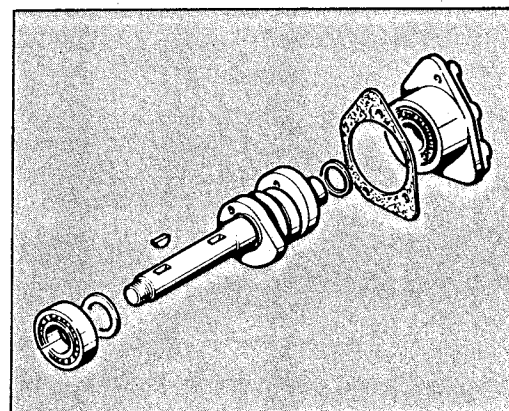
- Carefully check visually the closing rocker arm spring.
- No signs of cracks, deformation or slackenings must appear.

**Rocker arm - Rocker arm shaft assembly.**

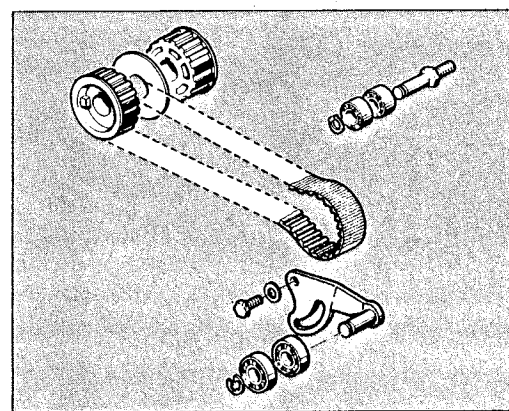
- Assembly tolerance must be:
0.03 ~ 0.06 mm (0.0012 ~ 0.0024 in).
- Service limit: 0.08 mm (0.0032 in).

**Camshaft and bearings.**

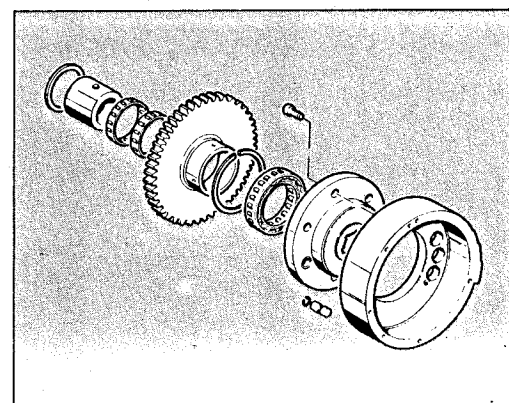
Check that the working surface of the cams are not scratched, grooved or waviness.
Check that lubrication conduits are free and clean.
Check camshaft bearings.

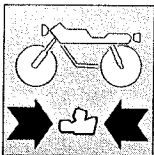
**Pulleys, belts and tensioners.**

Check that pulleys have no signs of wear or damage.
Check that belts are in perfect conditions, although it is advisable to change them at every overhaul.
Check if the ball bearing belt tensioner turns freely, without excessive play.

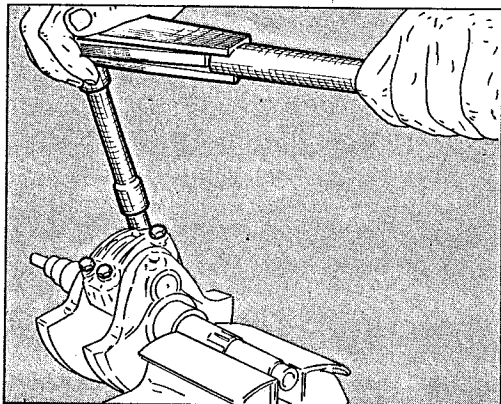
**Free wheel and starting mechanism**

Make sure that the free wheel works properly and that roller tracks are free of wear signs or any other damages.
Check that all gears are in good conditions.





ENGINE OVERHAULING

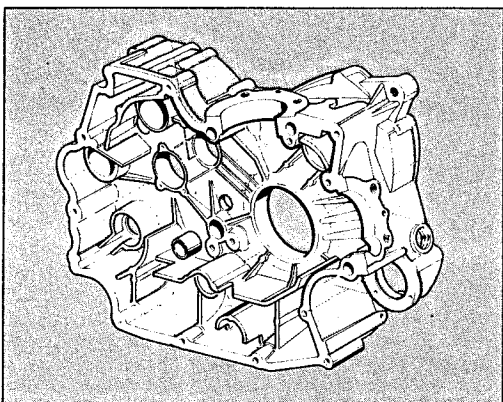
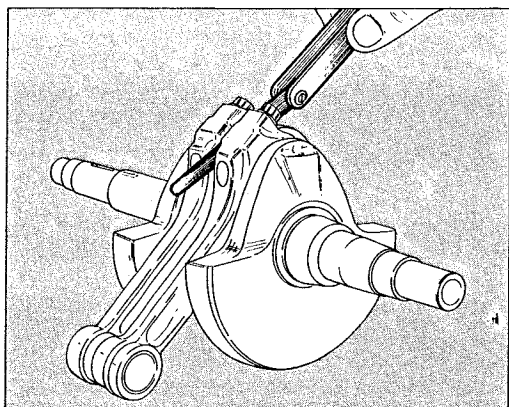


Crankshaft assembly.

- Check that conrod cap centering pins are fitted.
- Apply a liberal amount of engine oil to the connecting rods and caps and make sure that both are marked with the same number.
- Bolt on caps to connecting rods using brand new bolts.

Note: * Carefully grease bolts on thread and cap to ensure that the tightening torque applied is not lost in thread or cap friction.

- Apply tightening torque of
64 Nm, 6.5 Kgm or 47.01 lb/ft.
- Check connecting rod side play by means of a feeler gauge.
Side play: 0.15 ~ 0.35 mm (0.0059 ~ 0.0138 in).

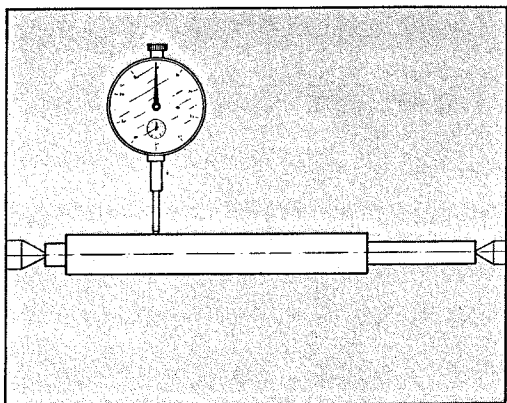


Crankcases.

- Carefully check visually crankcase.
- Check for flatness on a surface plate.
- Check that bearings and bushings are in good condition.

Note: * If bearings of bushings need to be changed, always replace both bearings of a set.

- Check that lubrication conduits are not obstructed.

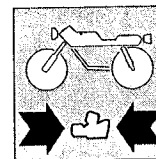


Check of shaft.

- To check if shafts are bent, place them in a truing stand.
- With the help of a dial gauge, check that shafts off-set is not more than 0.05 mm (0.0020 in).

Note: * When installing shafts in truing stand, adjust so centers are snug. Shafts must turn freely but may not be loose in centers.

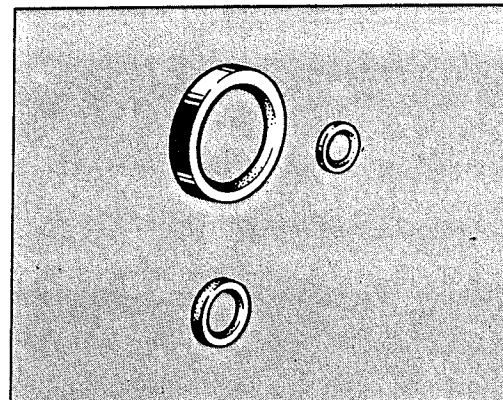
If shafts are loose or tight, indicators will not read accurately.

**Oil seals replacement.**

- Replace oil seals at every engine overhauling.
- When replacing oil seals, be sure that new seals are introduced perpendicular to its housing.
- When new oil seal is in its place, lubricate oil seal lip with a little oil or high temperature grease to reduce rubber to metal friction.

Note: * Replace any oil or grease seals that were removed with new ones, as removal generally damages seals.

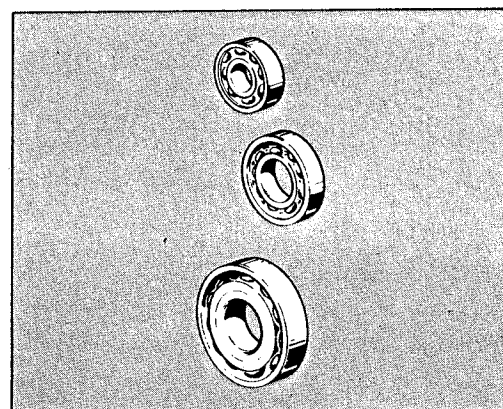
- * Seals should be pressed into place using a suitable driver, which contacts evenly with the side of the seal until the face of the seal is even with the end of the hole.

**Bearings.**

- Before checking bearings, wash them thoroughly with solvent and dry with compressed air.

CAUTION

- * Do not use compressed air to spin the bearings dry. This causes damage to the bearing surfaces.



- To check bearings, lightly oil them and rotate slowly the inner ring by hand. If hard spots, excessive play or uneven rotation is found, replace bearings.

Note: * Main bearings must always be replaced both at the same time and installed with the thicker part of the outside race facing away from the crankshaft.

- * It's advisable to replace main bearings at every engine overhauling.
- Oil the bearings liberally when installing.

Bearings replacement.

To replace bearings as follows:

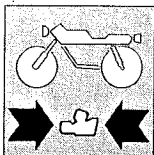
1. - Heat up crankcases in oven until reaching 100°C (212°F).
2. - Remove old bearings by means of a suitable Driver.
3. - While crankcase is still hot, install the new bearings perfectly in square with the housing axis.

CAUTION

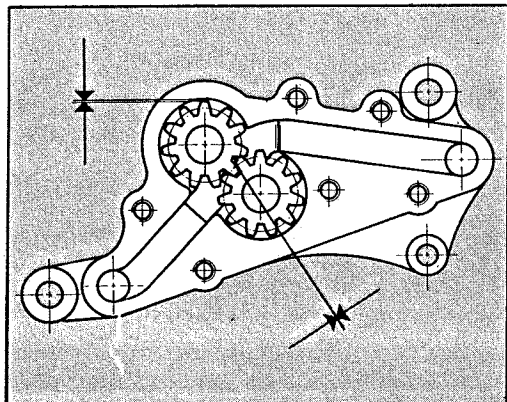
- * When installing a ball bearing, the outer bearing race which is affected by friction should be pushed by a suitable driver. This prevents severe stress on the ball and races, and prevents races and balls from being dented. Press a ball bearing until it stops at the stop in the hole or on the shaft.

4. - Live engine to cool down to room temperature and check if bearing is tightly fixed to the crankcase.





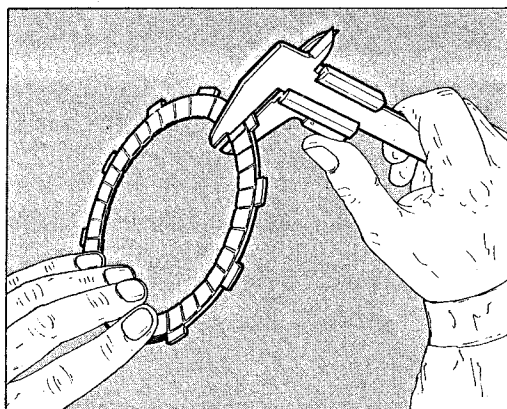
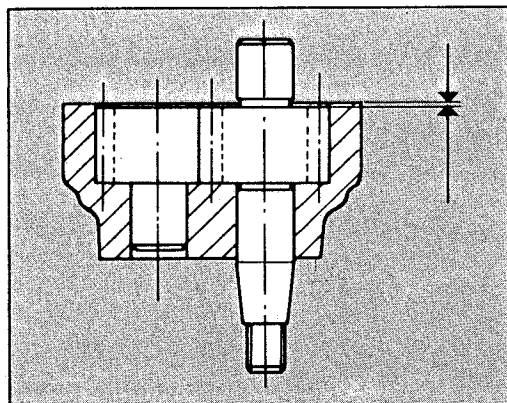
ENGINE OVERHAULING



Oil pump.

Carry out the following checks.

- play between gear teeth does not exceed 0.10 mm (0.0039 in).
- play between gears and pump body does not exceed 0.10 mm (0.0039 in).
- play between gears and cover does not exceed 0.07 mm (0.0028 in).
- the pump cover is free of dents, scores or any damage.



Clutch assembly.

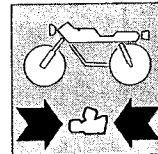
- Make sure that all clutch assembly components are in perfect condition.
- If clutch plates show signs of damage, or if they have worn past the service limit, replace them with new ones.

Service limit thickness: 3.3 mm (0.1299 in).

CAUTION

* If new dry steel plates and friction plates are installed, apply engine oil on the surfaces of each plate to avoid clutch plate seizure.

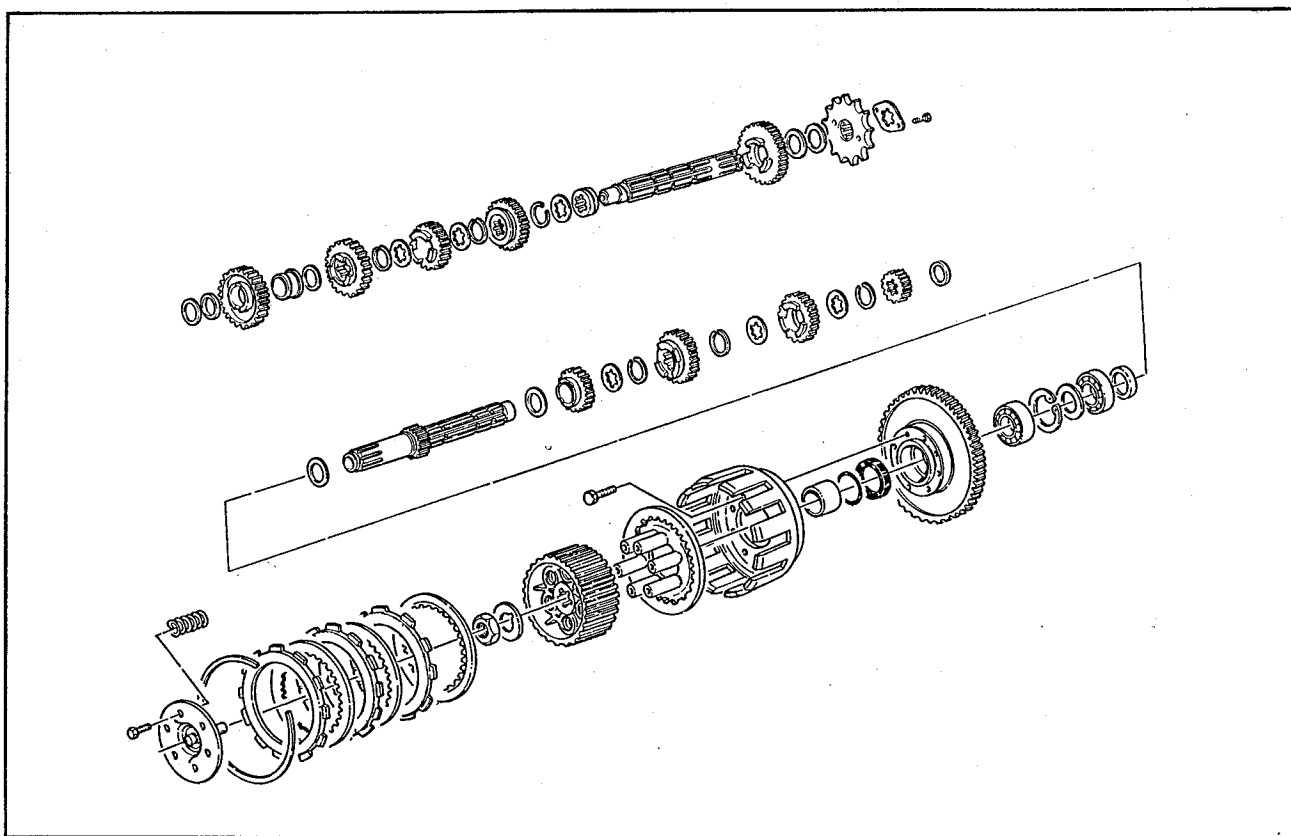
- Check that clutch spring free length is at least 41 mm (1.6142 in). If shorter replace with new springs.

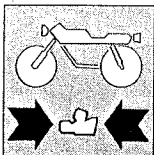
**Gearbox.**

- Check that engaging dogs edges in gears are still sharp.
- Check that idling gears freely rotate in the shafts and a side tolerance below 0.10 mm (0.0039 in).
- Shaft threads and sliding slots must be in good conditions.
- Check that sliding slots are within manufacturer's tolerances.

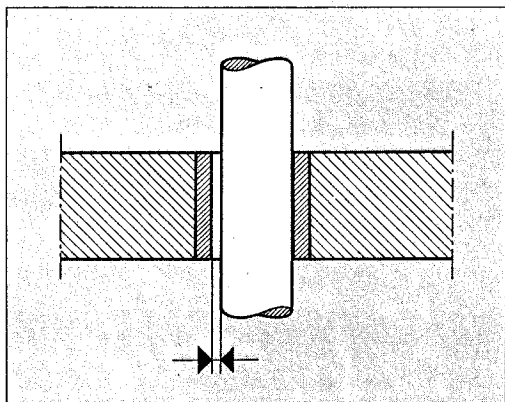
Service width: 8.0 ~ 8.09 mm (0.3150 ~ 0.3185 in).

Service limit: 8.19 mm (0.3224 in).





ENGINE OVERHAULING

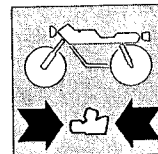


Shafts bushings.

- Check that all shaft bushing assemblies are within the tolerances specified by the manufacturer.

Tolerance: 0.02 ~ 0.03 mm (0.0008 ~ 0.0012 in).

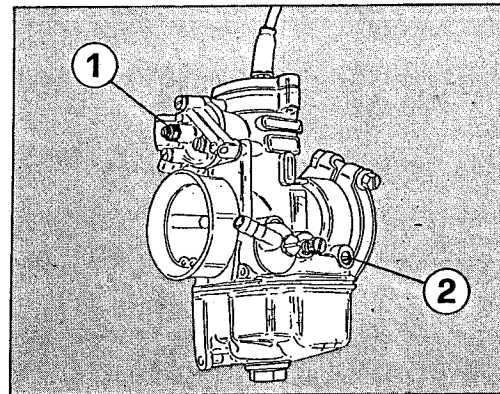
Service limit: 0.10 mm (0.0039 in).

**Carburetor overhauling.**

- Thoroughly wash with solvent and dry with compressed air all carburetor components.

CAUTION

- * Do not remove the adjusting screw 1 of accelerating pump. Every carburetor has been individually tested for better performance.
- * To clean all carburetor conduits or jets use only compressed air. If any metal wire or hard rod is used, damage can occur to soft conduit or jets walls changing air or gas flow causing carburation variations.



- Replace any "O" ring or plastic plug if damaged or deteriorated.
- Check for signs of wear in carburetor slide, needle or needle jet.

WARNING

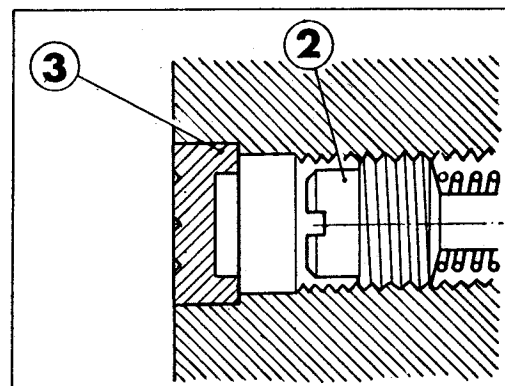
- * If carburetor slide sticks wide open check for dents or scraps in slide or carburetor body.
- * Operation with damaged sticking carburetor slide could result in an unsafe riding condition.

For US model only

- To remove the air screw, ② punch and pry off the plug with an awl or other suitable tools.
- Turn in the air screw ② and count the number of turns until it seats fully but not tightly, and then remove the pilot screw.

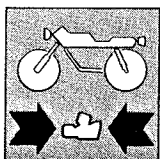
Note: * This is to set the pilot screw on its original position when assembling.

- When installing the pilot screw and plug, do as follows
 - Turn in the air screw fully but not tightly, and back it out the same number of turns counted during disassembly.
 - Install a new plug in the pilot screw hole.

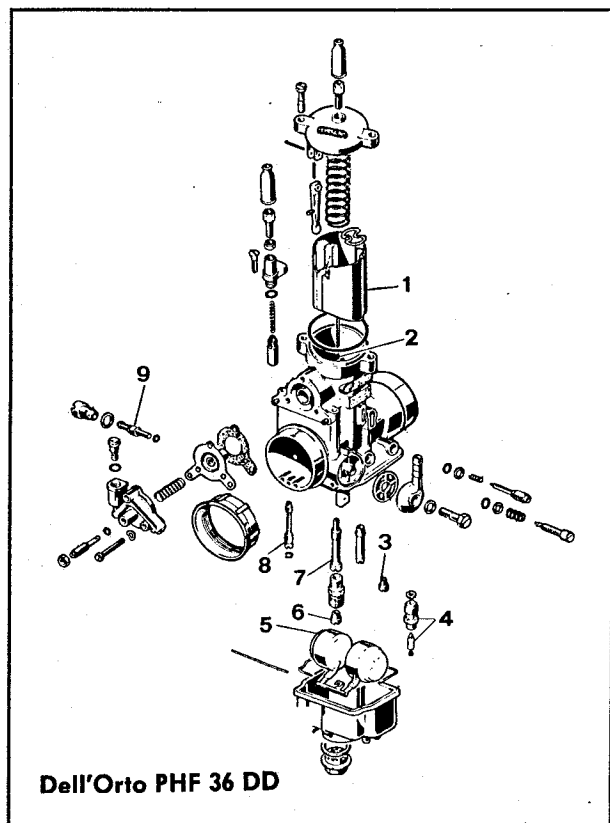
**CAUTION**

- * Failure to adhere to this operating procedure could cause emission limits to be exceeded. See the warning about "tampering" on page 2 of this Manual.



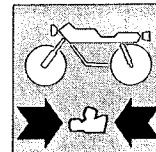


ENGINE OVERHAULING

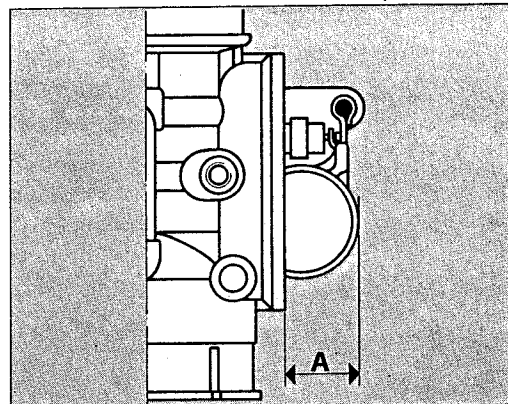


PHF 36 DD

1	Slide	60/3
2	Needle	K 18.2 2' tacca
3	Pilot jet	65
4	Needle valve	250
5	Float	tipo 10 gr.
6	Main jet	130 (horiz.) 132 (vert.)
7	Needle jet	265 AB
8	Choke jet	75
9	Acceleration pump jet	35
	Delivery of pick up pump	$5 \text{ cm}^3 \pm 0,5$ (4 times)
	Float level	17,5 + 18,5 mm.

**Float level.**

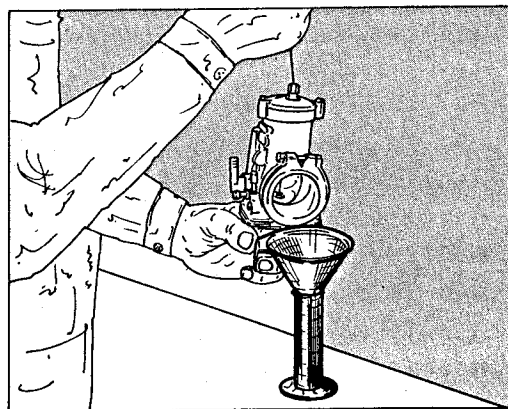
- Place vertically the carburetor on a flat surface.
- By means of a caliper check that distance A is: 17.5 ~ 18.5 mm (0.6889 ~ 0.7283 in).

**Accelerating pump fuel delivery.**

- Connect carburetor to a petrol tank.
- Use a funnel and graduated test tube to collect petrol.
- Rhythmically open and close 4 times, with few seconds interval, the carburetor slide.
- The amount of petrol collected in the test tube must be 4 c.c. $\pm$ 0.5.
- If adjustment is needed, act on adjustment screw.

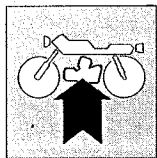
Turn it clock wise to reduce gas delivery.

Turn it anticlockwise to increase gas delivery.

**CAUTION**

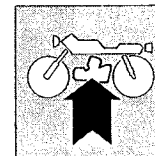
Do not remove the adjustment screw of the acceleration pump stroke.



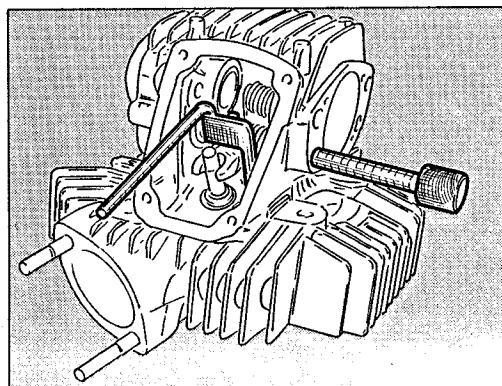
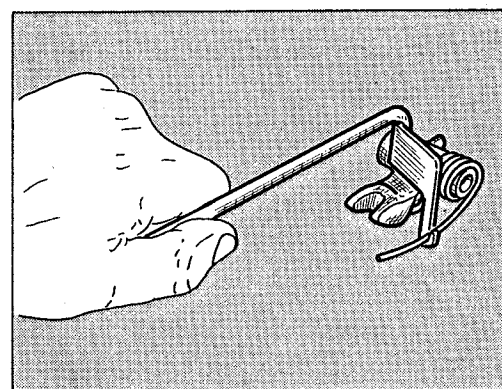
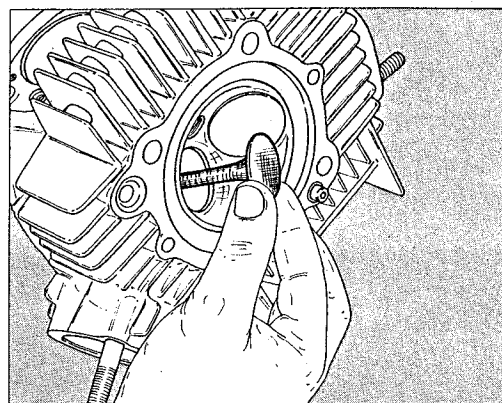
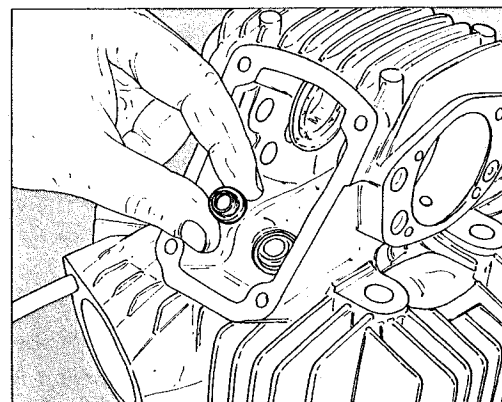


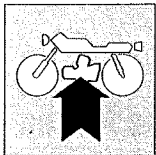
H

- H.2 Valves
- H.2 Lower rocker arm
- H.3 Camshaft
- H.5 Upper rocker arm
- H.6 Valve covers
- H.7 Mainshaft
- H.7 Countershaft
- H.7 Shift forks
- H.7 Selector drum
- H.8 Shift forks shafts
- H.8 Crankshaft
- H.8 Camshaft driving shaft
- H.8 Oil pressure adjustment valve
- H.9 Crankcase
- H.12 Crankshaft primary transmission pinion
- H.12 Oil pump
- H.13 Clutch assembly
- H.15 RH side cover
- H.16 Shift mechanism assembly
- H.16 Countershaft sprocket
- H.17 Starter motor
- H.18 Starter gears
- H.18 Camshaft driving gear
- H.20 Ignition flywheel
- H.20 Alternator rotor
- H.21 Pick-up back plate
- H.22 Ignition cover
- H.22 Piston and cylinder
- H.24 Cylinder head
- H.25 Camshaft timing

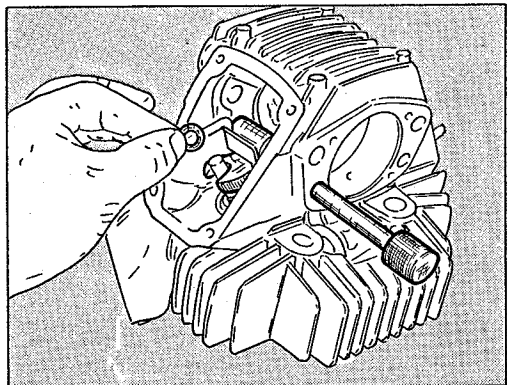
**Valves.**

- Install oil seal.
- Install valve.
- Place the lower rocker arm and spring in valve spring compressor tool ☆42410.
- Place the lower rocker arm - spring - spring compressor in cylinder head and hold in place by means of shaft tool ☆42405.

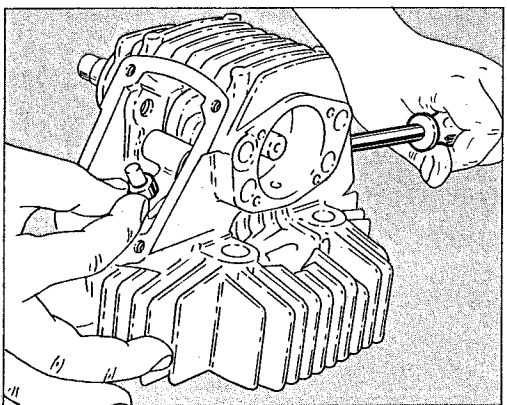
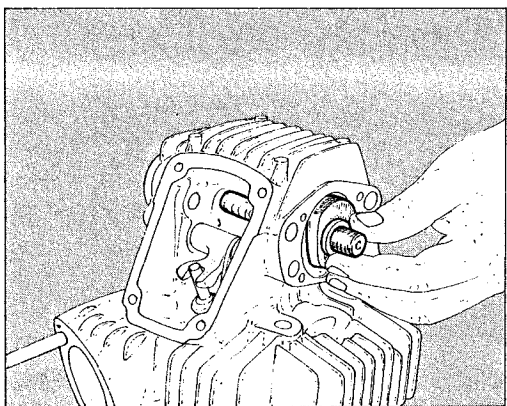
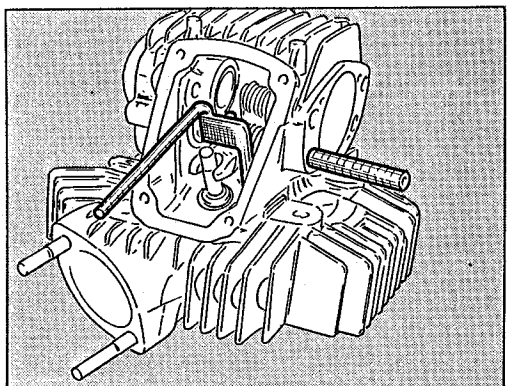


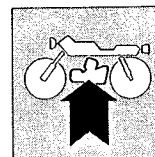


ENGINE RE-ASSEMBLY

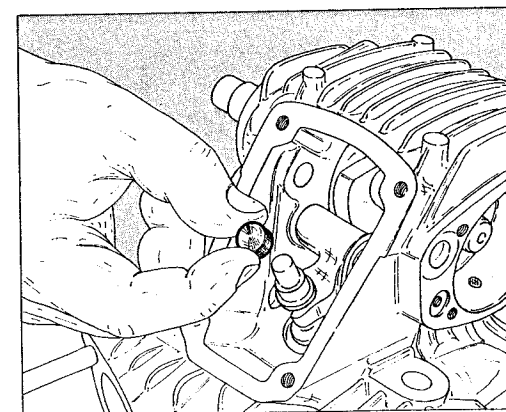
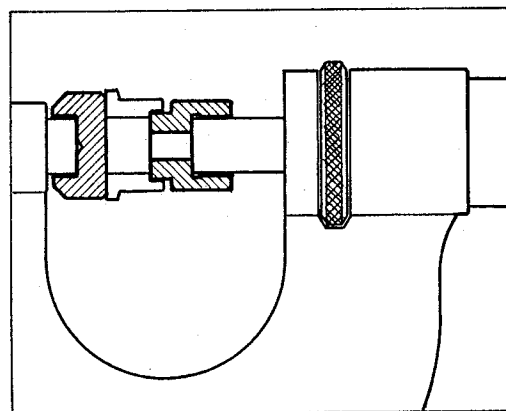
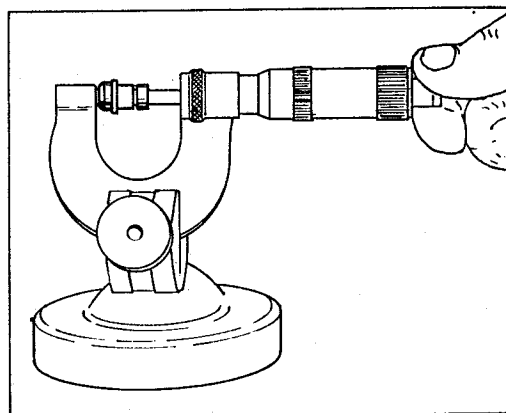
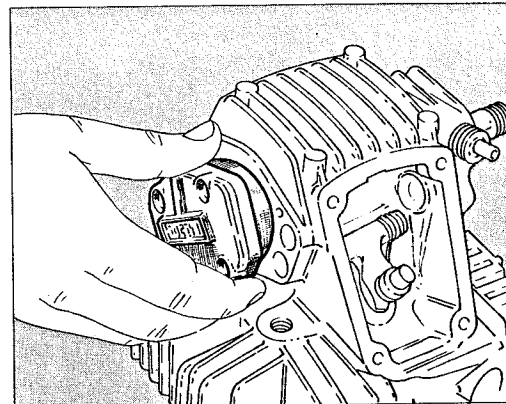


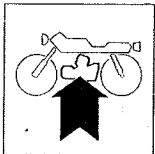
- Shim the sides of rocker arm and bring it to perfectly centered position respect to valve stem. The rocker arm must be free to move with no axial play.
- Remove shaft tool ☆ 42405 and replace by the rocker arm shaft with the hole facing outwards.
- Unlock the spring and remove the spring compressor tool.
- Place the camshaft inserting the woodruff key of the tachometer driving gear (only in the cylinder head of horizontal cylinder).
- Turn camshaft and with the aid of a screw driver lift the rocker arm end that features a sliding shoe.
- Place the return cap and cap retainers.



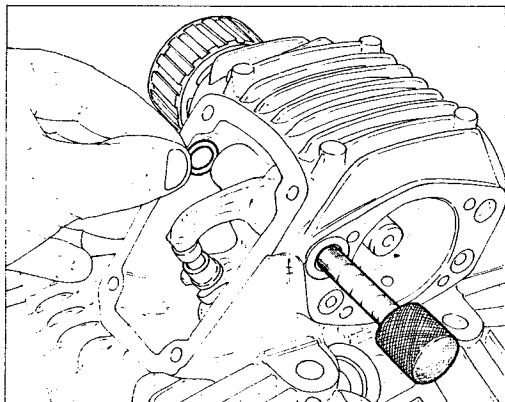


- Temporarily mount camshaft supporting caps.
- Check that there is no play between rocker arm sliding shoe, and cam; returning cap can still be rotated by hand.
- If too tight or too loose check the tolerances with a feeler gauge.
- Different returning caps thicknesses are supplied as spare parts to adjust play.
- Use micrometer and returning cap holding tools for accurate measurement.





ENGINE RE-ASSEMBLY

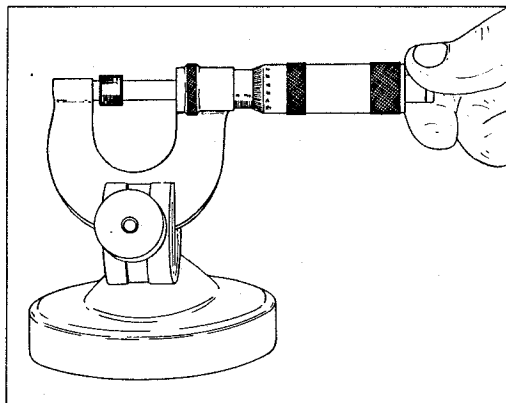
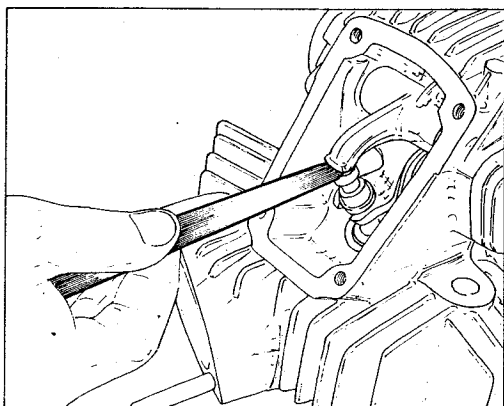
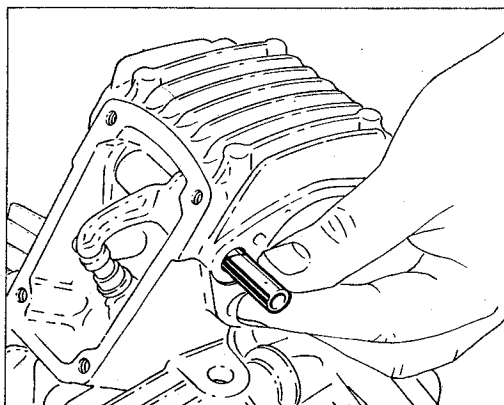


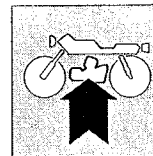
Upper rocker arm.

- Place opening arm and adjust side play in the same way of lifting or lower rocker arm with the help of shaft tool ☆ 42405.
- Substitute shaft tool by rocker arm tool, with the hole facing outwards.
- Temporary mount camshaft supporting caps so camshaft is supported at both ends.
- Check play between rocker arm slide shoe and pushing cap using a feeler gauge.

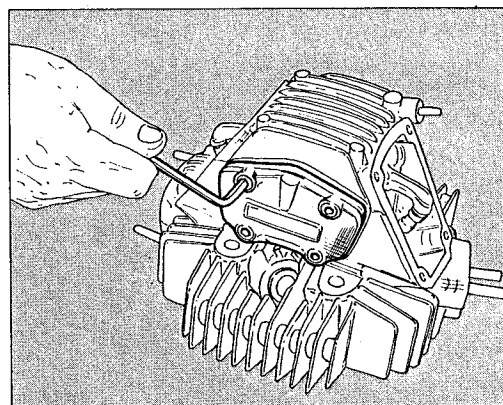
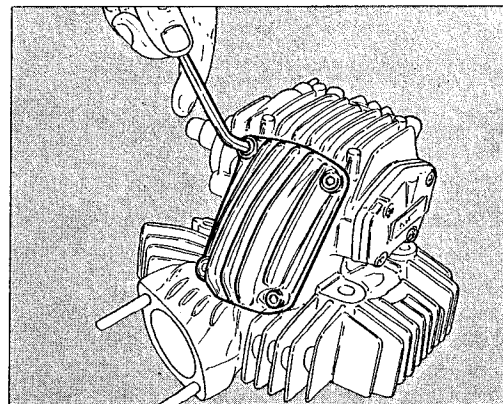
Service tolerance: 0.10 mm (0.0039 in).

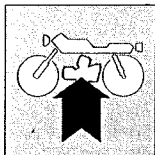
- Different pushing cap thicknesses are available to adjust play.



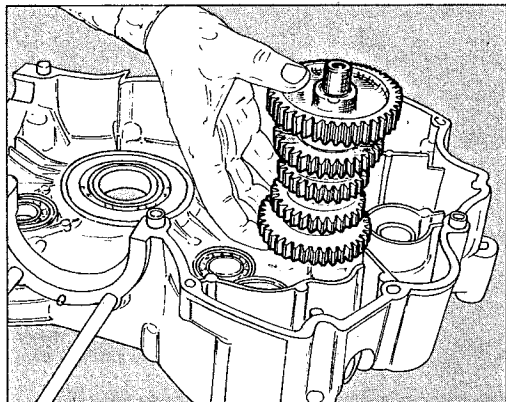
**Valve covers.**

- Tight allen bolts of valve covers.
- Tight allen bolts of camshaft supporting side caps.



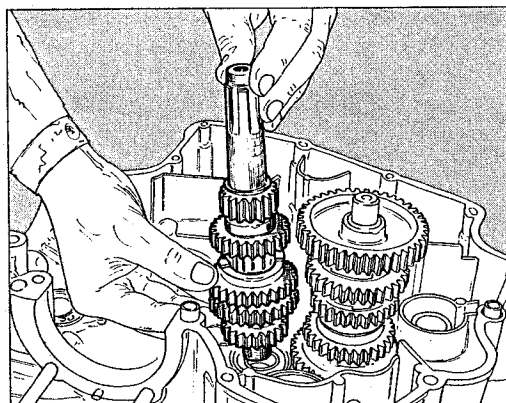


ENGINE RE-ASSEMBLY



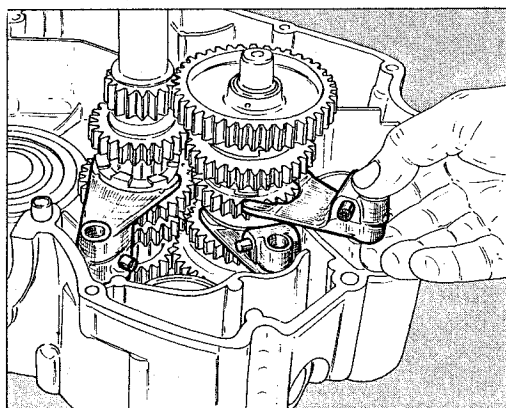
Mainshaft.

- Place Mainshaft on left side center case, complete with gears and shims.



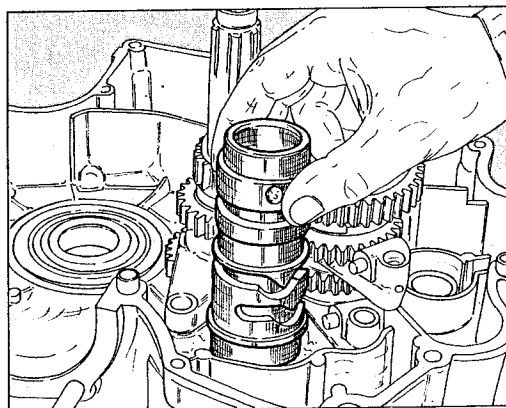
Countershaft

- Place Countershaft assembly.



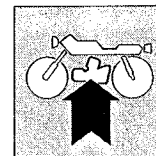
Shift forks.

- Place shift forks.

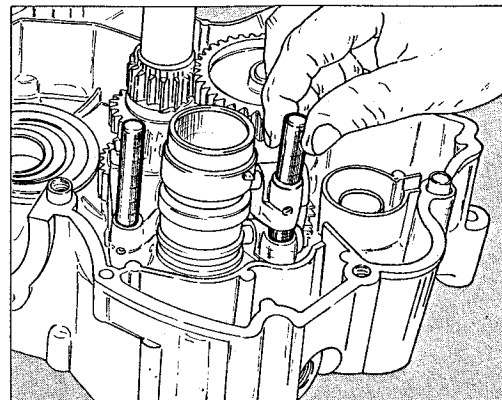


Selector Drum.

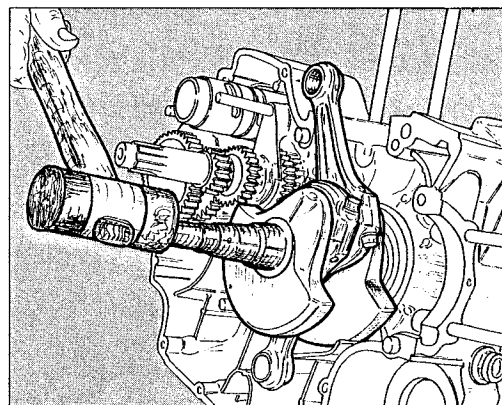
- Place Selector Drum.

**Shift forks shaft.**

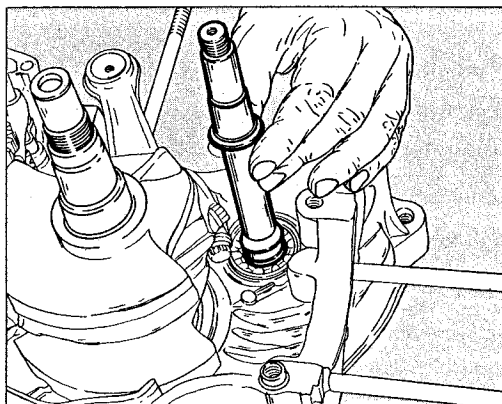
- Place shift forks ends in selector drum slots.
- Place shift forks shafts.

**Crankshaft.**

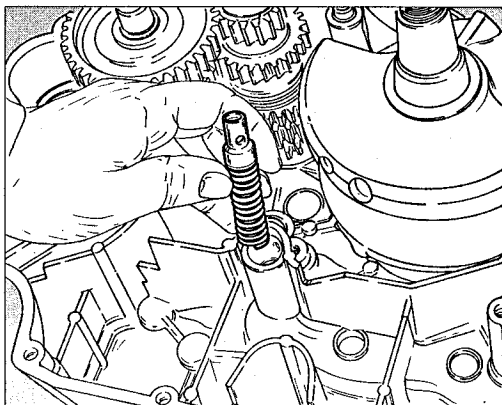
- Place crankshaft with shims, tapping slightly with a rubber or plastic hammer.

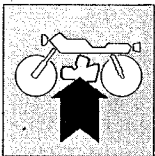
**Camshaft driving shaft.**

- Place camshaft driving shaft with shims in its bearing.

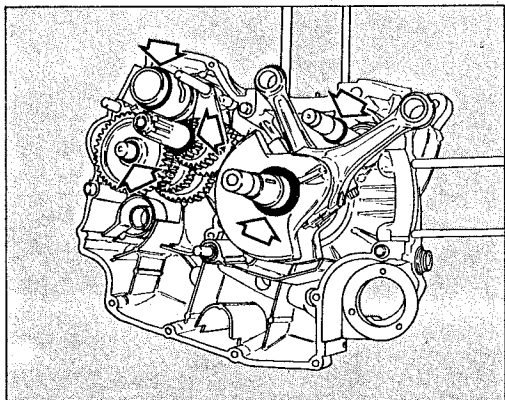
**Oil pressure adjusting valve.**

- Place oil pressure adjusting valve and spring.



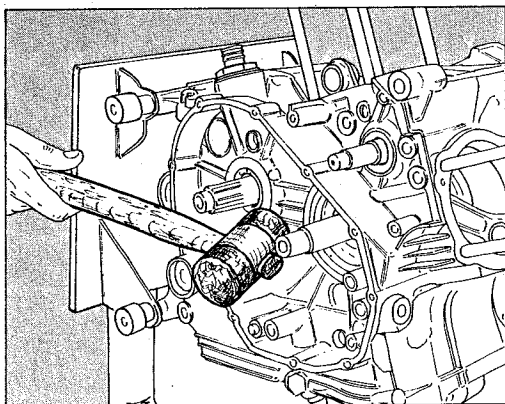
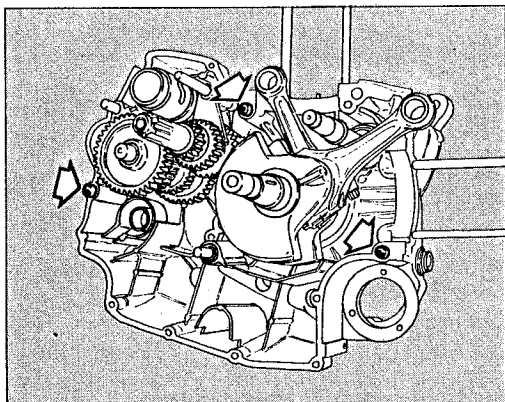
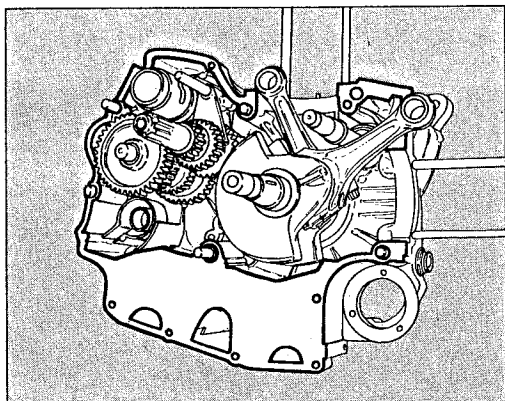


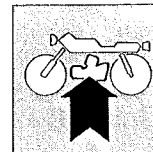
ENGINE RE-ASSEMBLY



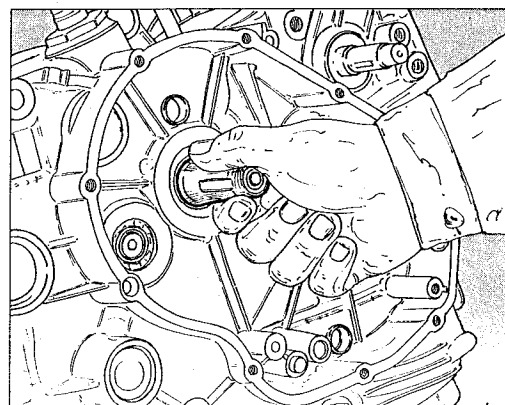
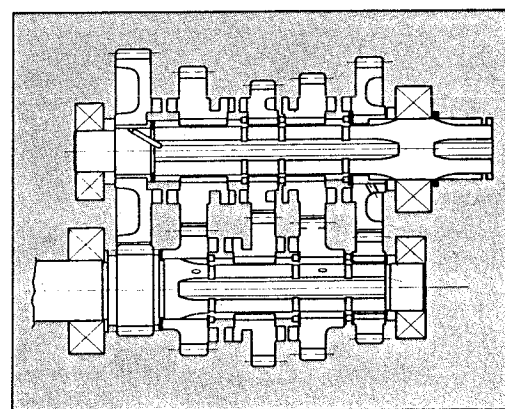
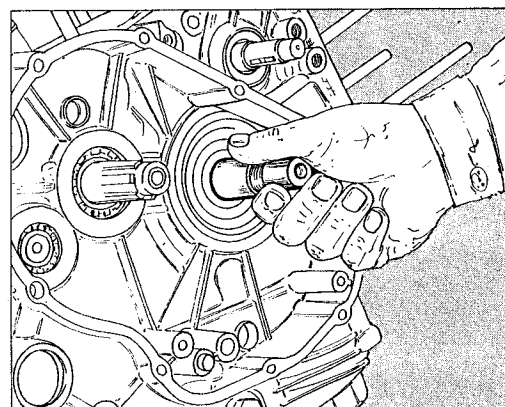
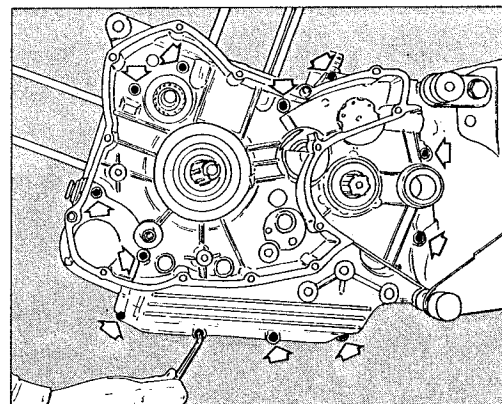
Crankcases.

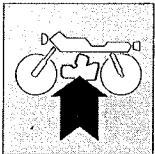
- Make sure that the shim adjustment washers have been positioned on shafts and selector drum.
- Place new center case gasket, using some grease to keep it in place.
- Check that crankcase centering bushings are in place.
- Join the two crankcases taking care that all shafts are correctly placed in their housings.
- Tap a few times with a plastic hammer to make sure that the parts are matched correctly.



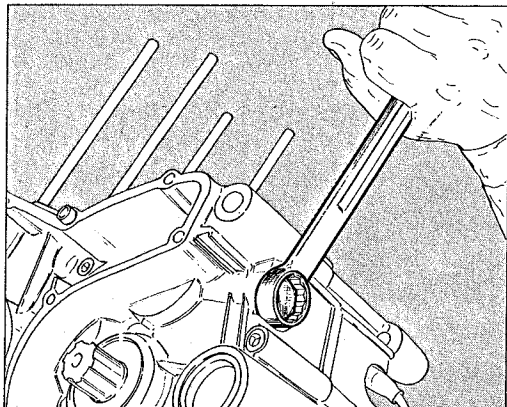


- Tighten thoroughly and progressively crankcase bolts.
- Check that crankshaft rotates freely but with no side play.
- Check that gearbox shafts have an axial play of $0 \sim 0.20$ mm (0 $\sim$ 0.0079 in).
If axial play is greater, adjust by means of adjusting shims.
- Check that all assembled parts rotate freely.

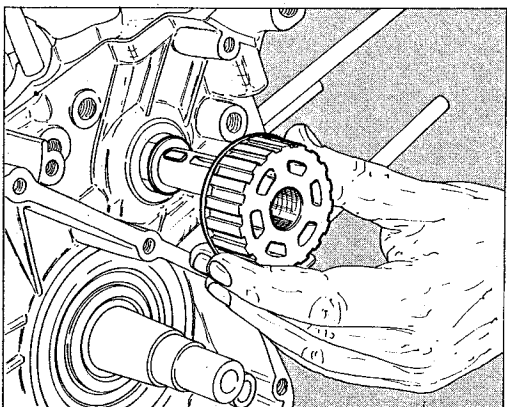




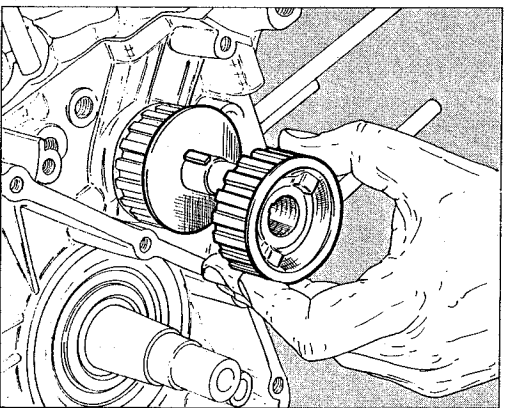
ENGINE RE-ASSEMBLY



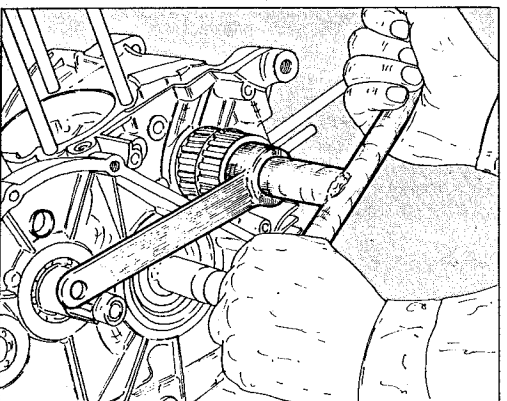
- Place and tighten selector drum positioning pin assembly.



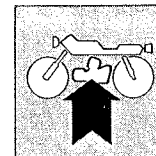
- Place key and inner pulley on camshaft driving shaft.



- Place key and outside pulley on camshaft driving shaft.

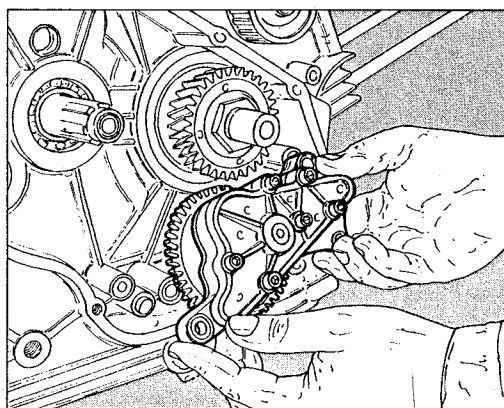
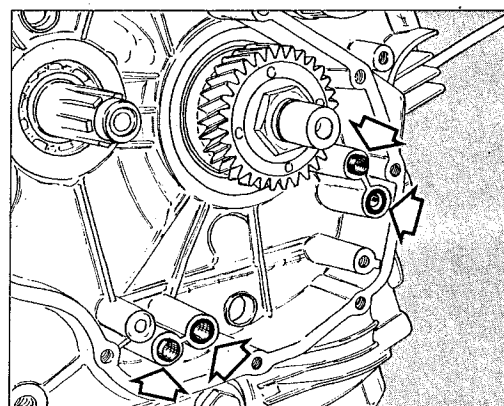
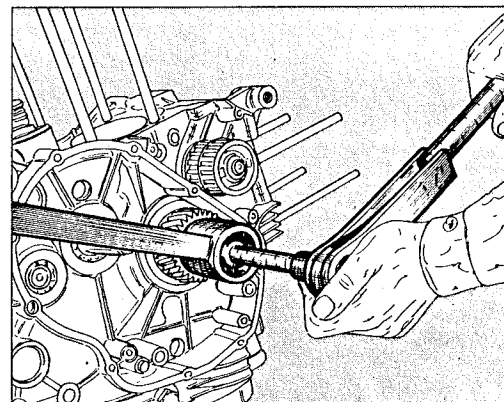


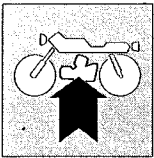
- Lock pulleys by means of tool ☆ 42415, and tight on thoroughly self-locking nut using wrench ☆ 42414.



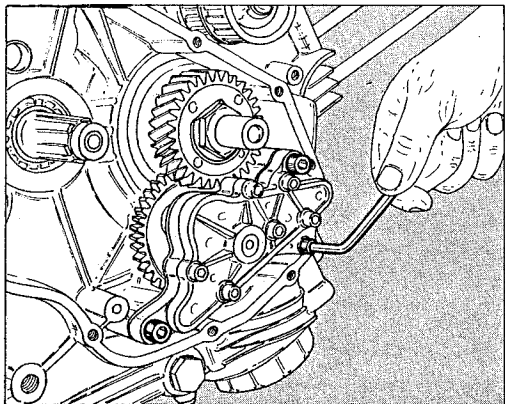
Crankshaft primary transmission pinion.

- Place woodruff key and pinion on crankshaft.
- Place the locking washer, lock the gear by means of tool ☆ 42409 and tighten the fixing nut to a torque of 90 Nm, 10 Kgm or 72.33 lb/ft.
- Bend locking washer tab.
- Place reference bushings and "O" rings in the crankcase.
- Completely fill the oil pump with engine oil and place it on the crankcase.

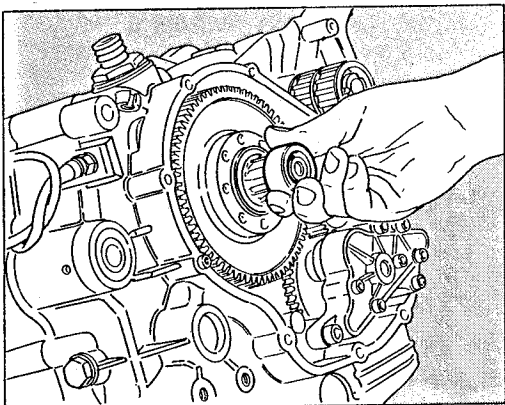
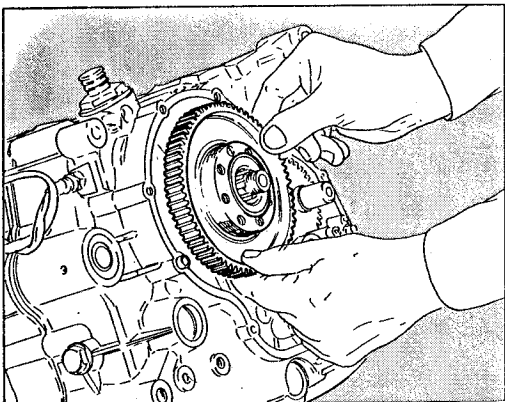
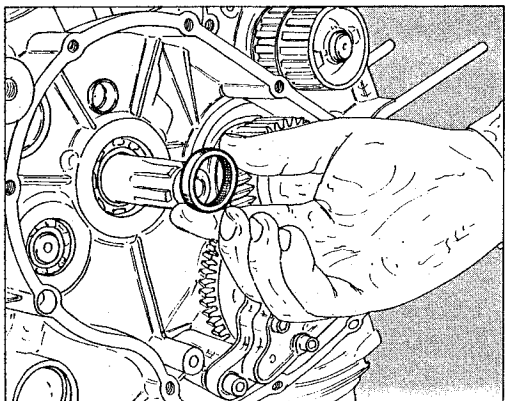


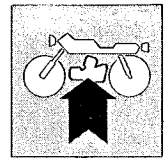


ENGINE RE-ASSEMBLY

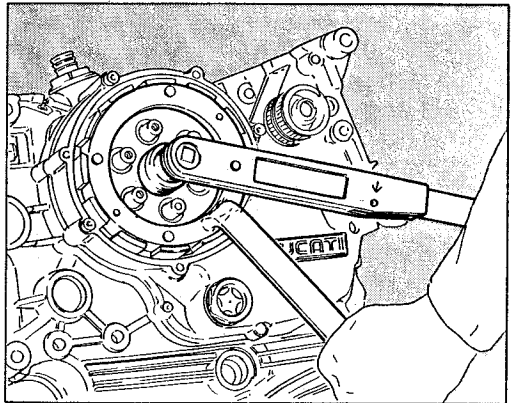
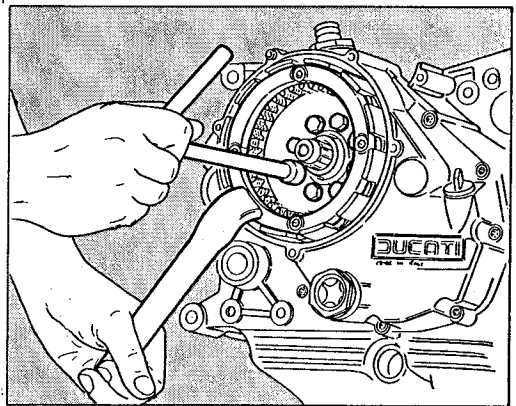
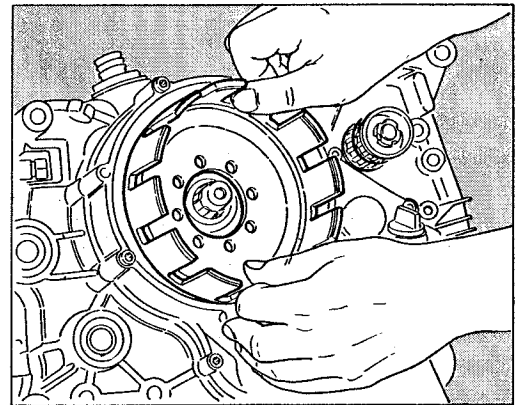
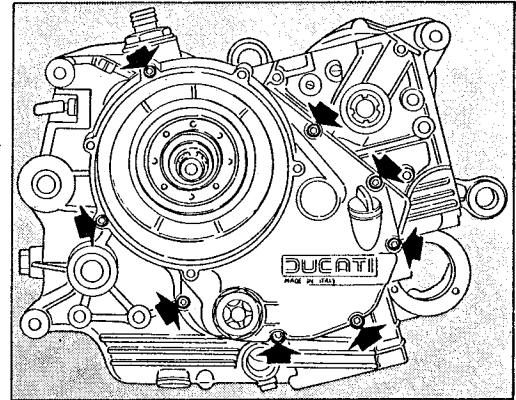


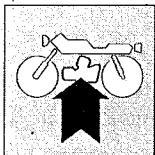
- Thoroughly tighten oil pump fixing bolts.
- Place bushing on mainshaft.
- Place primary gear.
- Place bushing on mainshaft.



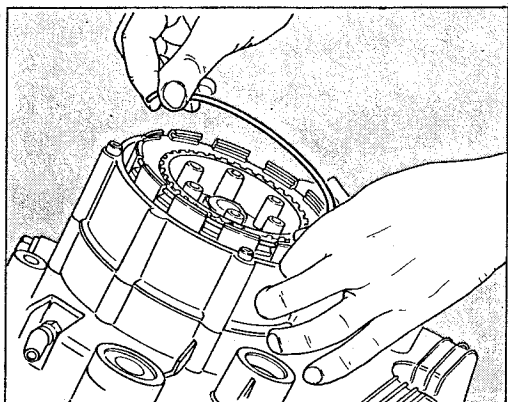


- Place gaskets and primary transmission cover.
- Place cover bolts and tighten on.
- Place clutch housing, holding bolts and tighten on, lock clutch housing by means of tool ☆ 42403.
- Place clutch hub and clutch spring plate.
- Place locking washer and lock the clutch drum with tool ☆ 42403. Lock the fixing nut to a torque of 136 Nm, 14 Kgm, or 101.2 lb/ft.
- Bend back the washer.
- By means of a screwdriver, push the spring plate.
- Place clutch plates, keeping in mind that the first plate to be placed is the special driven plate with bend teeth. Bend teeth should be pointing to the outside. The last plate to be placed is the special driving plate.

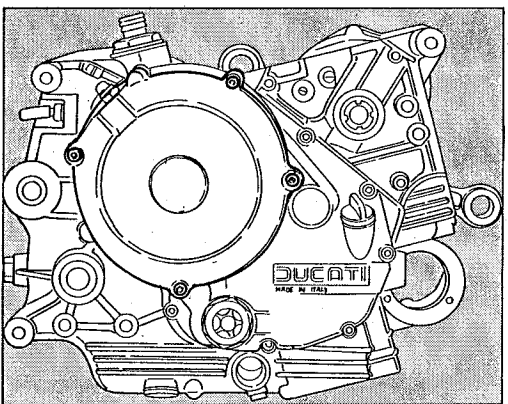
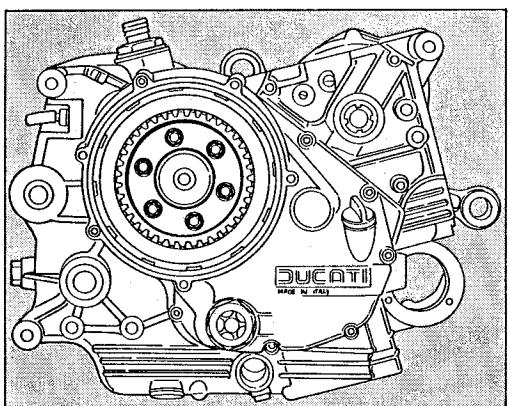


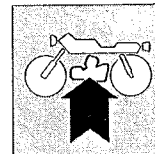


ENGINE RE-ASSEMBLY

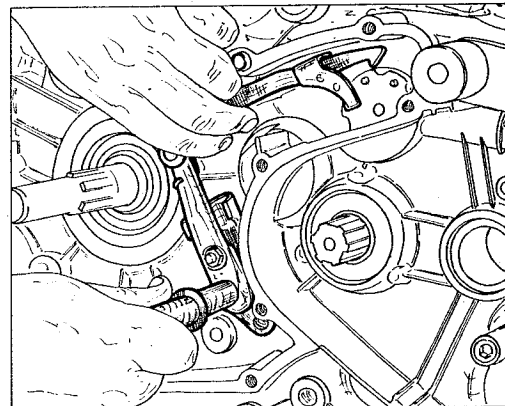


- Place the plate retaining circlip.
- Place clutch springs.
- Place clutch springs holding plate and tighten on bolts.
- Place clutch plates cover and tight on bolts.

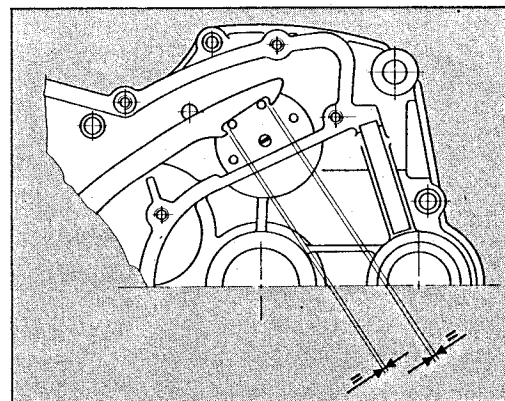


**Shift mechanism assembly**

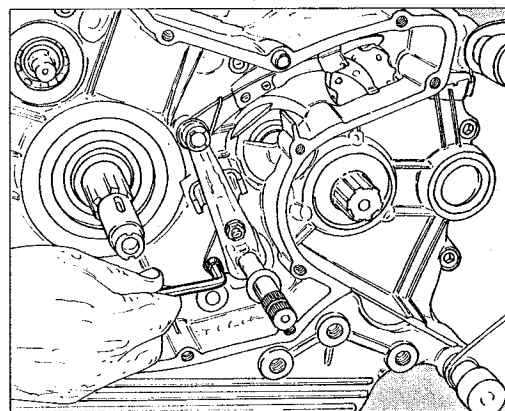
- Place shift mechanism assembly.



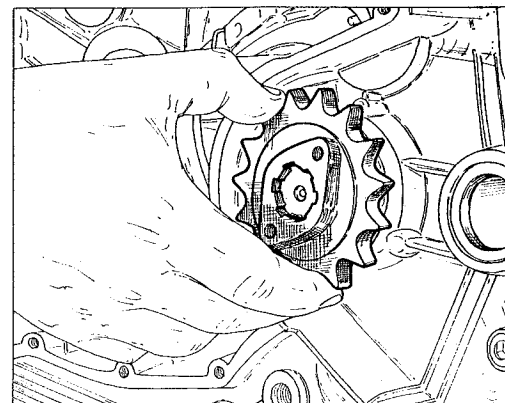
- Place shift mechanism lever in center of selector drum.

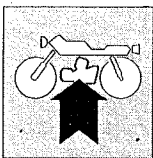


- Tighten shift mechanism plate support.

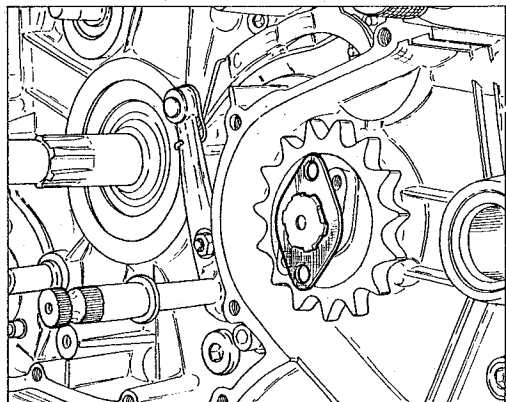


- Place countershaft sprocket.

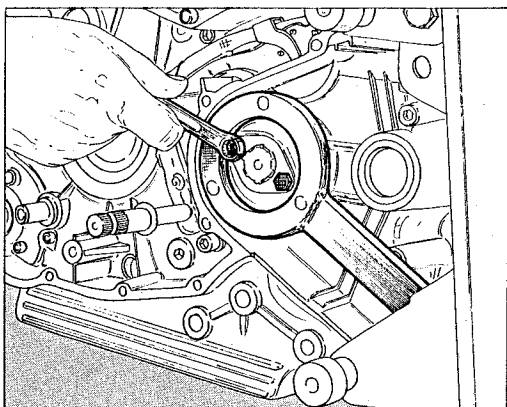




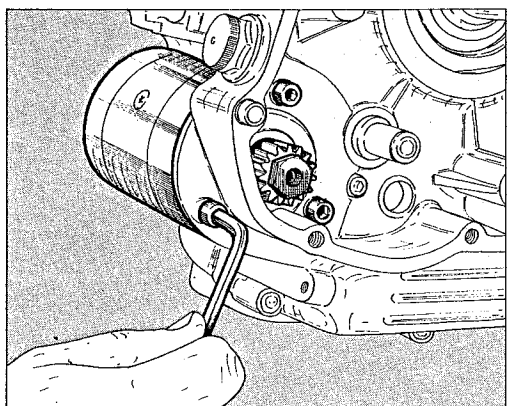
ENGINE RE-ASSEMBLY



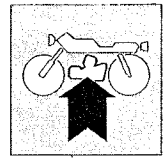
- Place countershaft sprocket holding plate by sliding it thru shaft grooves and rotating inside slot until facing threaded holes on countershaft sprocket.



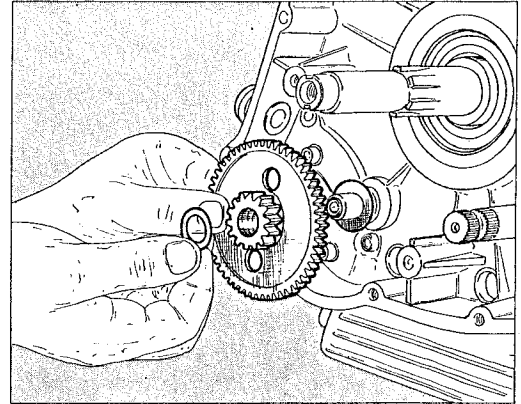
- Tighten bolts by meaning of service tool.



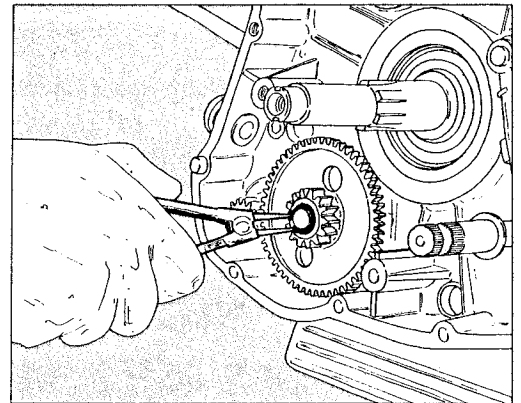
- Place starter engine gasket, engine starter and thoroughly tighten the bolts.

**Starter gears**

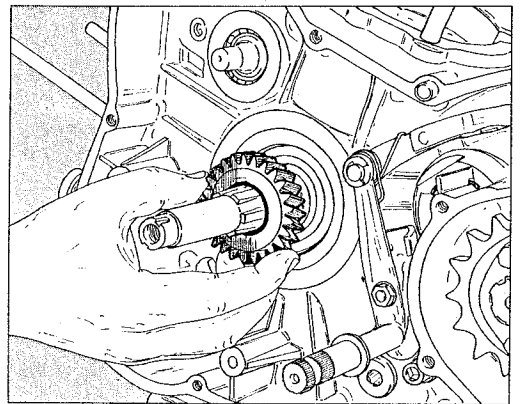
- Place starter idling gears and shims.



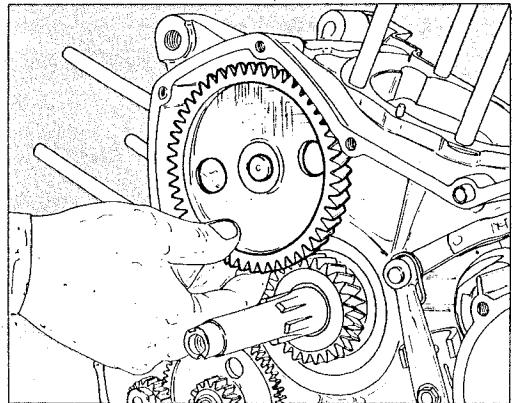
- Place snap ring.

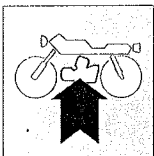


- Place camshaft driving pinion on crankshaft.

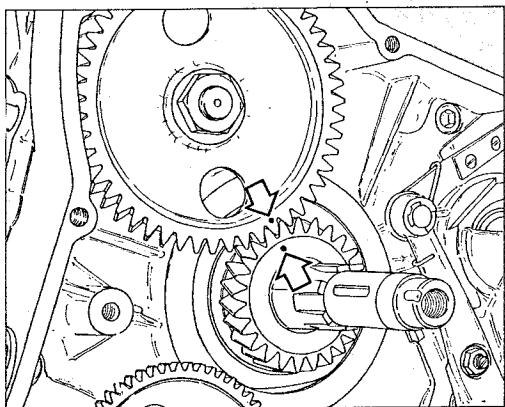


- Place key and camshaft driving gear.

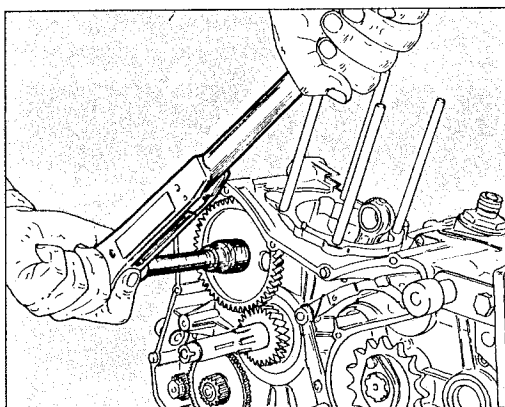




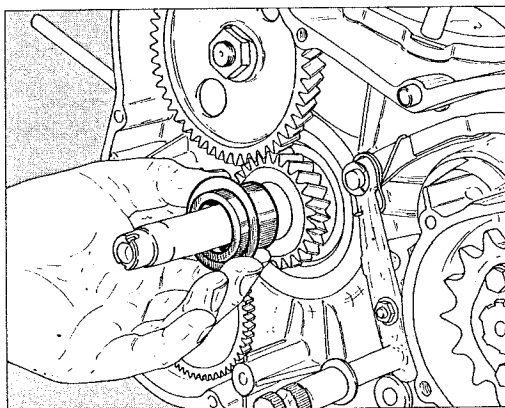
ENGINE RE-ASSEMBLY



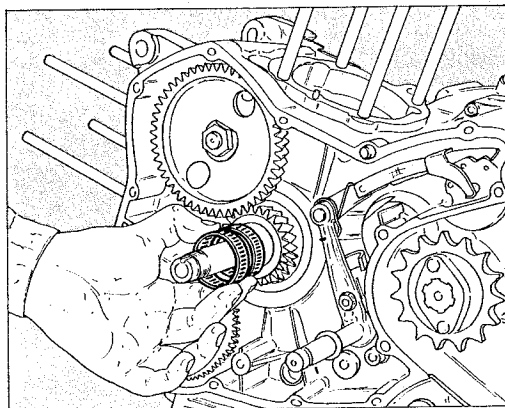
- Place countershaft driving gear so the mark on it faces the mark on the crankshaft driving pinion.



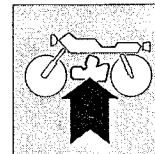
- Place locking washer and tight on nut with a torque of Kgm or 28.93 lbs/ft
Bend washer tab.



- Place steel bushing and washer on crankshaft.

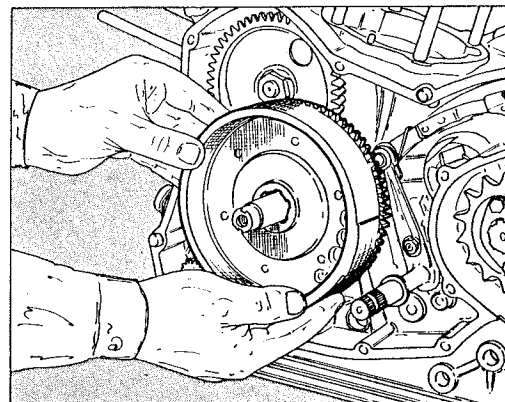


- Place the two needle bearings.

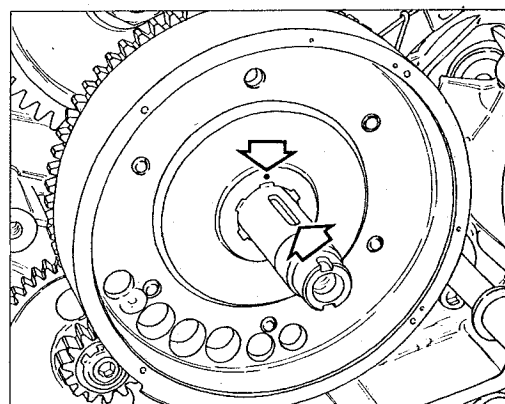


Ignition flywheel

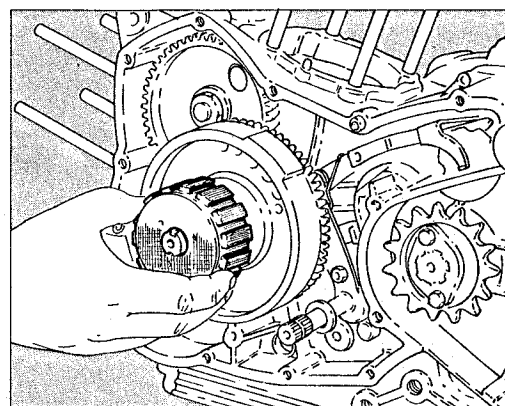
- Place the ignition flywheel and freewheel assembly including starting idling gear.



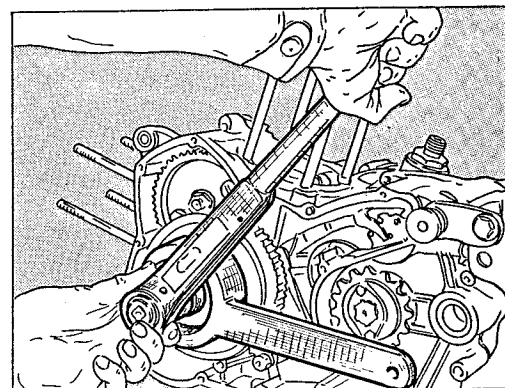
Note: * The ignition flywheel must be placed with the mark facing the key slot.

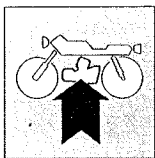


- Place key and the generator rotor.

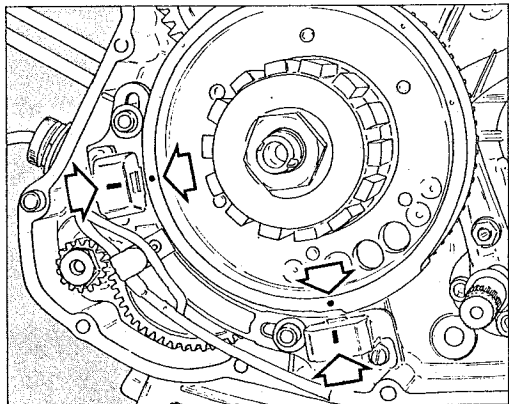


- Place locking washer, lock the rotor by means of tool ☆ 42652 and tighten fixing nut to a torque of:
108 Nm, 11 Kgm, 79.56 lb/ft.
Bend locking washer.

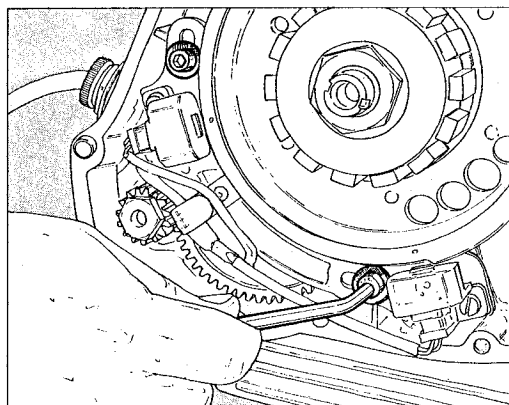




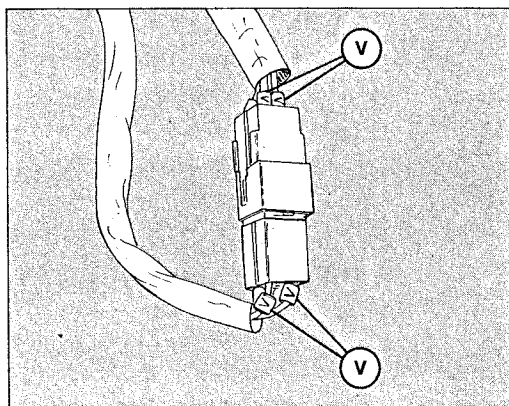
ENGINE RE-ASSEMBLY



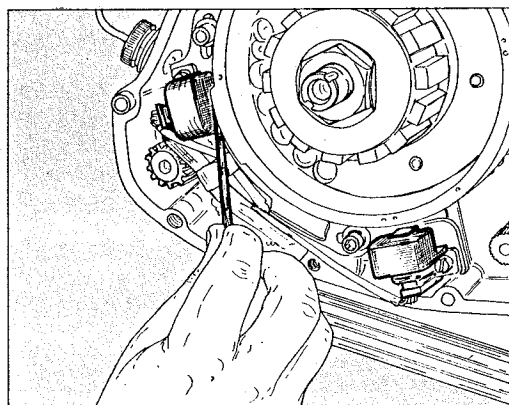
- Place pick-up back plate and the fixing bolts, tighten the bolts only finger tight.
- With horizontal cylinder in T.D.C (top dead center) have the pick-up reference marks face the marks in ignition flywheel.



- Tight on pick-up backing plate bolts.



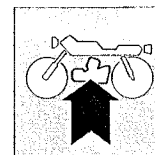
- Plug in pick-up cables.
- Make sure that the cables with the same letter (O or V) face each other.



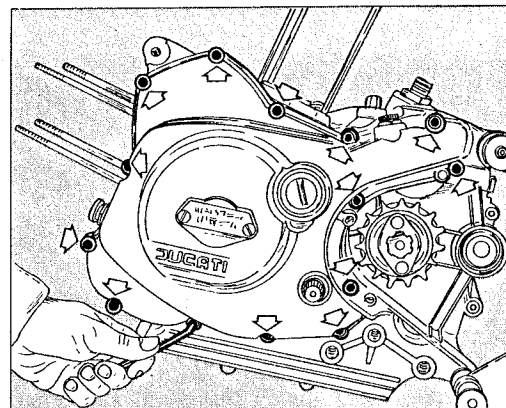
- Gap between pick-up and ignition flywheel higher step must be 0.50 ~ 0.55 mm (0.0197 ~ 0.0217 in)

CAUTION

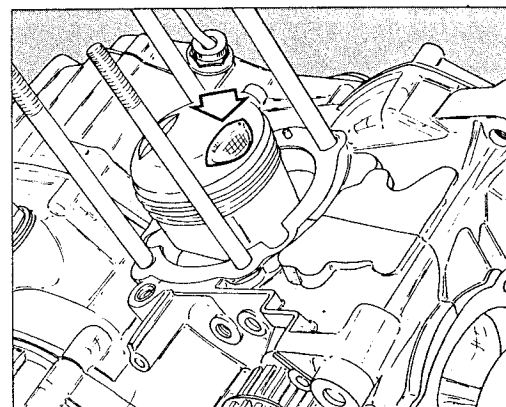
- * Never reverse ignition cable connector.
- * If mounting instructions are not carefully followed, engine may fail to run properly.

**Ignition cover**

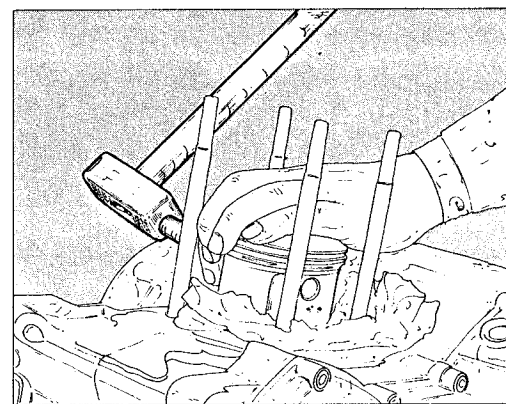
- Place side cover and tighten bolts.

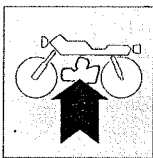


- Place piston so that the smallest indent faces towards the exhaust valve.

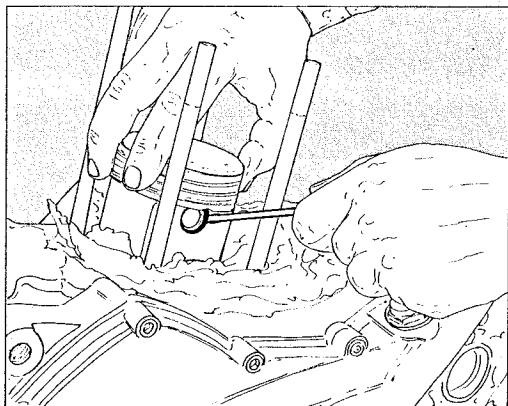


- Hold piston and mount piston pin with the help of a plastic hammer.





ENGINE RE-ASSEMBLY



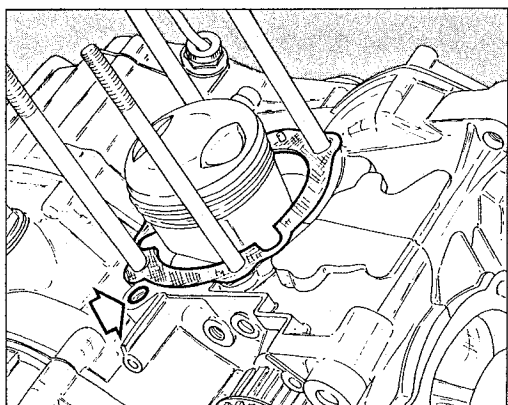
- Place piston pin snap rings in piston grooves.

CAUTION

- * Do not reuse snap rings, as removal weakens and deforms the snap ring. It could fall out and score the cylinder wall.

- Place cylinder base gasket and vertical cylinder "O" Ring.

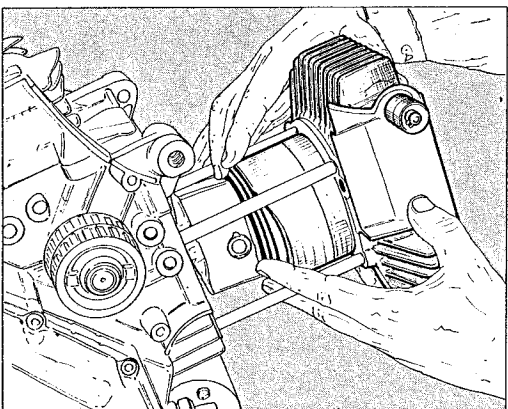
Note: * Place piston rings on piston with piston ring end openings at 120° in order to create a labyrinth.



- Lubricate cylinder with oil engine and insert piston in cylinder.

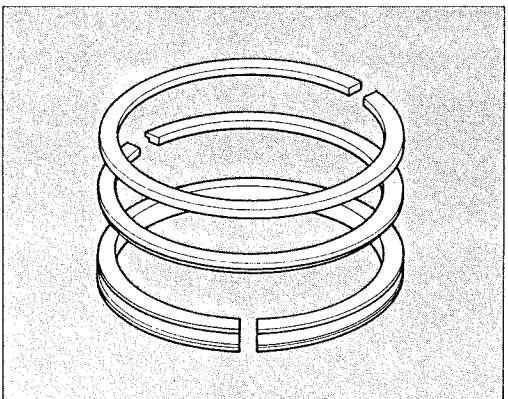
Note: * To insert piston in cylinder, use universal a piston ring compressor adapter.

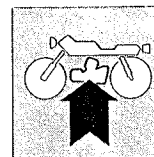
- * If piston ring compression adapter is not available cylinder is still possible to assemble if piston rings are carefully compressed with the fingers.



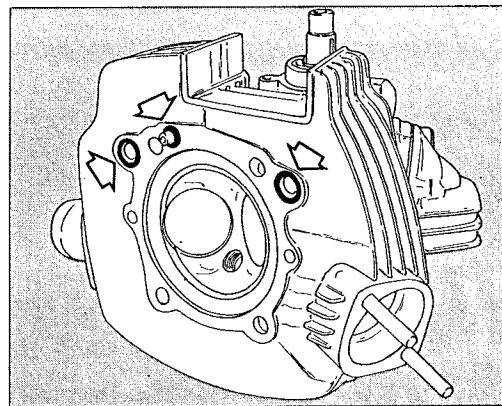
CAUTION

- * If piston rings are not compressed properly when mounting the cylinder, they can be broken due to their brittleness.

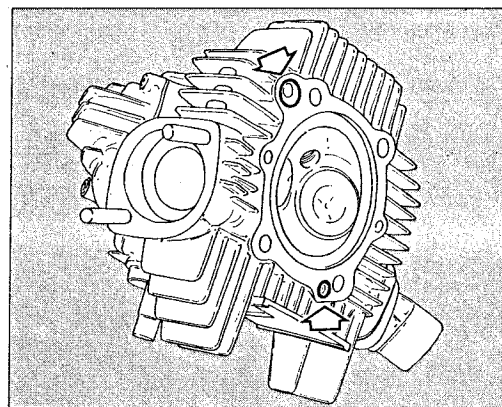


**Cylinder head**

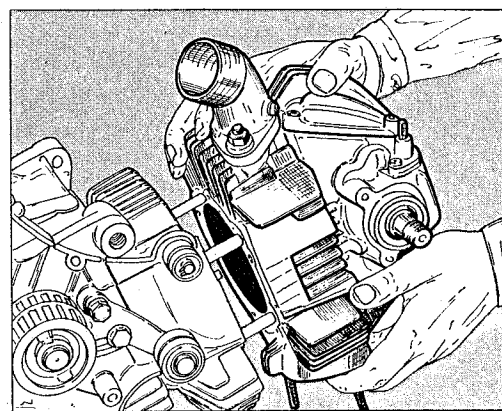
- Place the three "O" rings on vertical cylinder head.



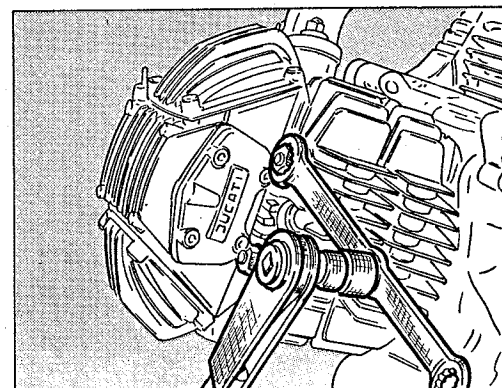
- Place the three "O" rings on horizontal cylinder head.
- Push down pistons so they are not at T.D.C, so that they will not touch the valves.

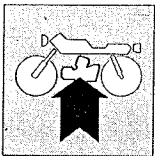


- Install the cylinder heads.

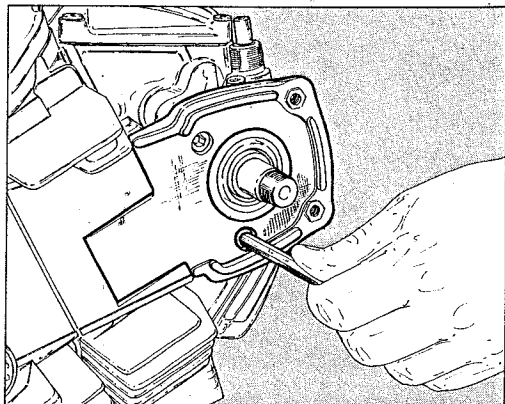


- Tighten head bolts on a Cross pattern to a torque of: 34 Nm, 3.5 Kgm, 25.31 lb/ft., using special wrench # 42407.



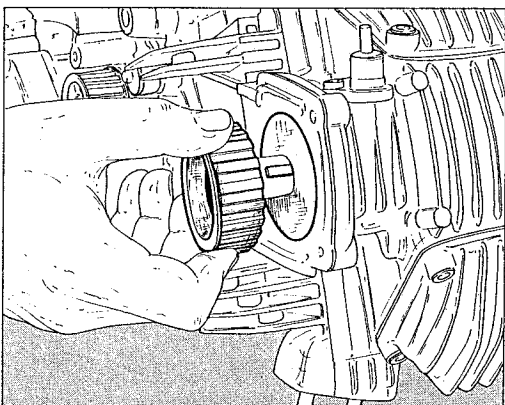


ENGINE RE-ASSEMBLY

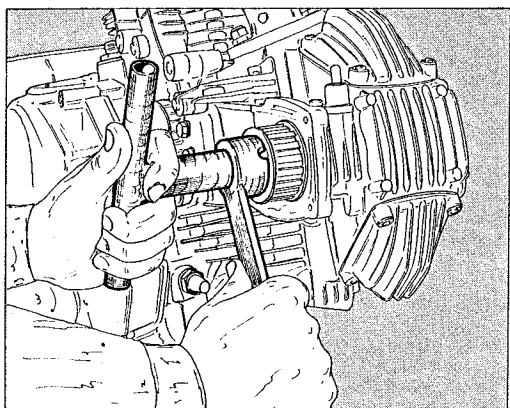


Camshaft timing

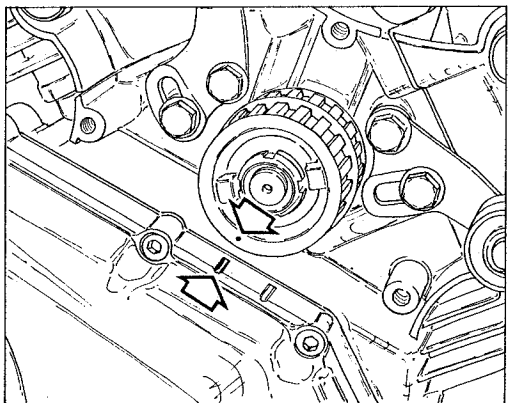
- Place rubber back cap and tighten bolts.



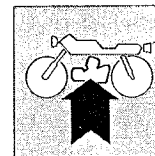
- Place guiding washer, key and pulley on camshaft.



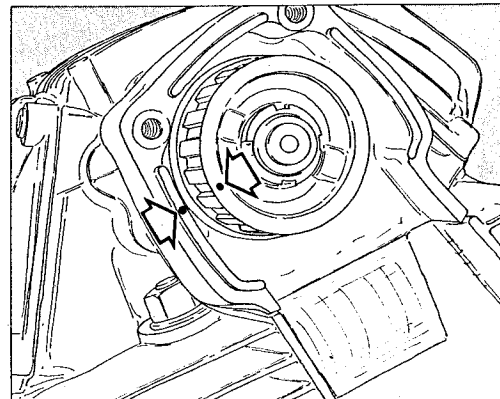
- Lock pulley by means of tool ☆ 42415 and tighten self-locking nut using tool ☆ 42414.



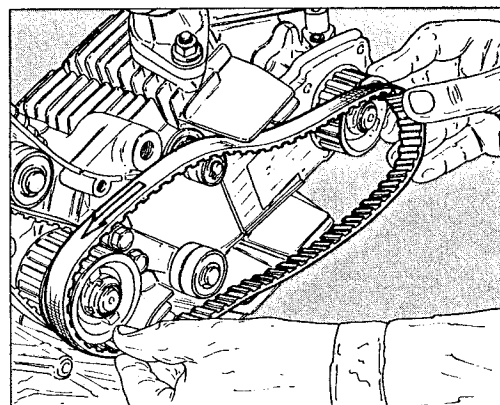
- Turn camshaft until ref. mark on pulley faces ref. mark on crankcase.



- Turn camshaft until ref. mark in pulley face ref. mark in rubber back cap.

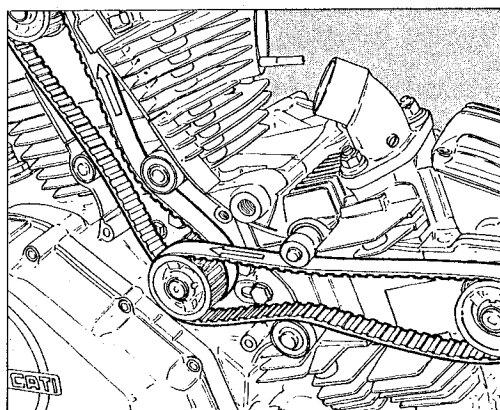


- Place toothed belts by only means of your hands.

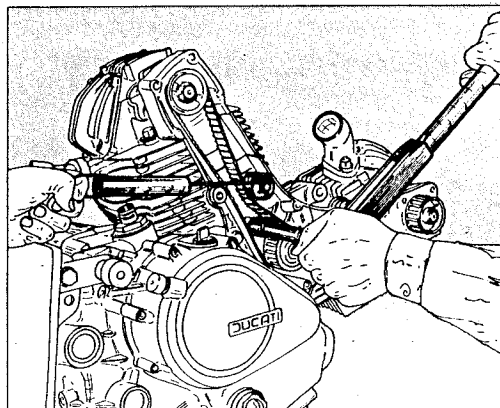


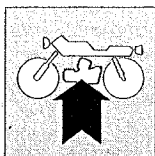
- If previously disassembled belts are used, place them according to marks.

Note: * It is recommended to change belts at every engine overhaul.

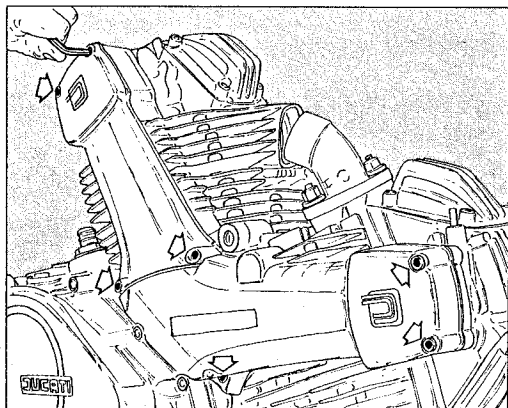


- To tighten belt tensioner, apply dynamometric stretcher ☆ 42406 and pull it to the ref. mark.
Lock bolts to:
24 Nm, 2.5 Kgm, 18.08 lb/ft.

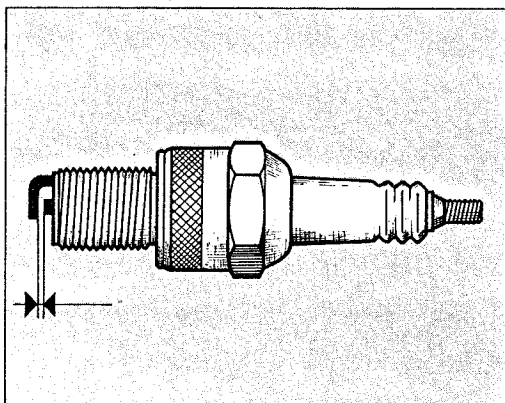




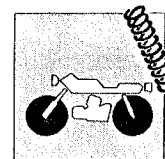
ENGINE RE-ASSEMBLY



- Place belts side covers and tighten bolts.

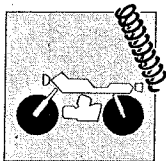


- Carefully clean the spark plugs and check electrodes gap:
0.6 mm (0.0236 in).
- Install the spark plugs and torque
at 18 lbs/f 2.5 Kgm.

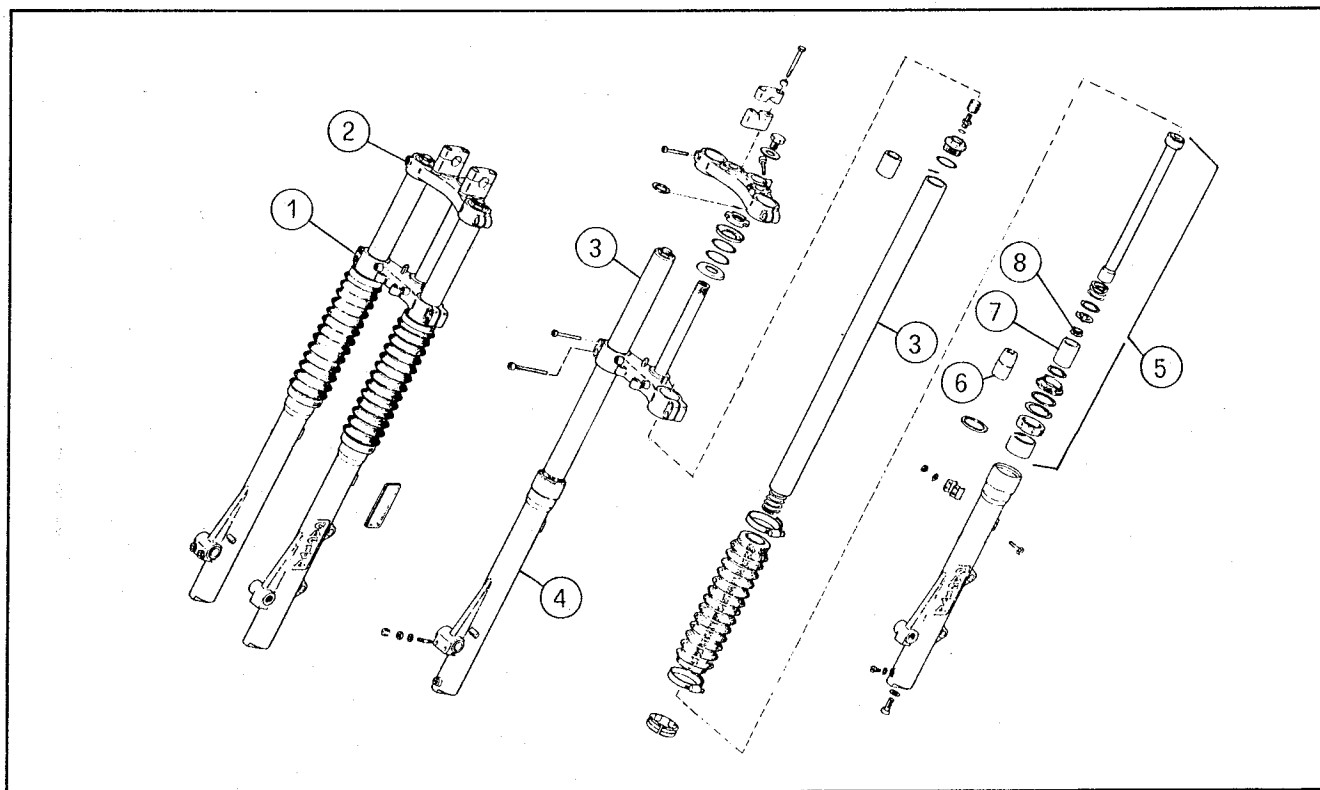


- I.2 Front suspension
- I.3 Front forks removal
- I.3 Oil seal, dust seal
- I.3 Inspection
- I.4 Inner tube
- I.5 Oil change
- I.6 Rear suspension
- I.7 Swing arm
- I.8 Wheels tires
- I.10 Wheel rim
- I.10 Front wheel removal
- I.11 Rear wheel removal
- I.12 Wheel bearings
- I.12 Bearing replacement
- I.12 Wheel bearings installation





SUSPENSIONS AND WHEELS



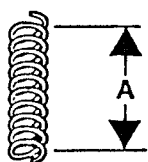
Front suspension.

Front suspension is of the hydraulic type with double damping effect.

Front fork consist of the fork legs connected to the frame head pipe by the stem base ① and stem head bracket ② .It accomplishes shock absorption through spring action and resistance to the flow of the oil forced into the cylinder by tube movement. Each fork leg is telescopic tube including an inner tube ③ , outer tube ④ , cylinder and piston unit ⑤ and cylinder base ⑥ . The inner tube fits into the outer tube, altering its position in the outer tube as the tube arrangement absorbs shocks. The cylinder is fixed to the bottom of the outer tube and the piston (equipped with a piston ring) is secured to the top of the cylinder. The collar ⑦ , coupled with a return control valve ⑧ , fixed in the lower end of the inner tube, forms the upper part of the lower chamber and together with the piston helps seal the upper chamber. The collar and cylinder base configuration function to form an oil lock at the end of the compression stroke to prevent the inner tube from striking the bottom. Taper on damping rod, at piston side, bring about an oil lock at the end of the extension stroke to prevent the inner tube from striking the top.

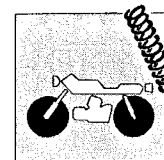
The front fork legs of this model contains springs only as suspending element.

Springs



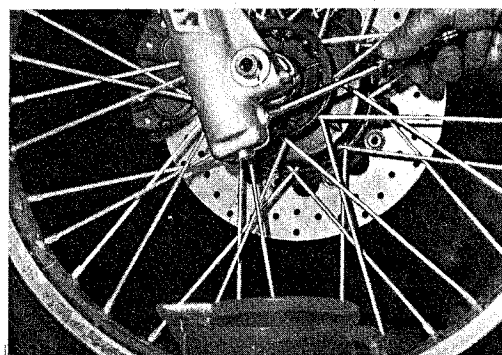
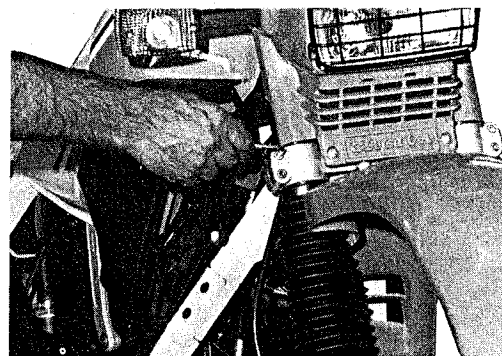
Since the spring becomes shorter as it weakens, check its free length A to determine its condition. If the spring of either fork leg is shorter than the service limit, it must be replaced. If the length of a replacement spring and that of remaining spring vary greatly, the remaining spring should also be replaced in order to keep the fork legs balanced for motorcycle stability.

For spring free length service limit A = 520 mm (20.47 in)



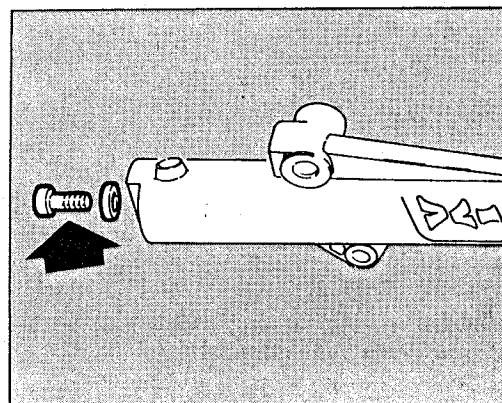
Fron forks removal

- Remove wheel as described in page I.10.
- Remove front brake hose clamp and speedometer driving cable clamp.
- Remove front brake caliper.
- Loosen top and bottom steering stems bolts .
- Slide down both fork legs.
- Remove fork leg caps.
- Remove spring.
- Drain oil from fork leg.
- Remove allen bolt from base of outer tube.



Note: * If allen bolt can't be removed because the damping shaft turns, introduce thru the opening of the inner tube a long rod with a flattened head to block the damping rod and prevent it from rotating.

- Pull apart both, inner and outer tubes.



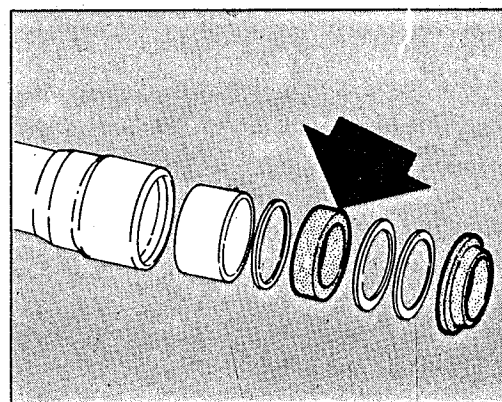
Oil seal, dust seal.

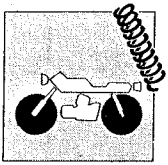
Oil is prevented from making out by the seal wich is fitted at the upper end of the outer tube. A dust seal on the outside of the tube keeps dirt and water from entering and damaging the oil seal and tube surface.

Inspection.

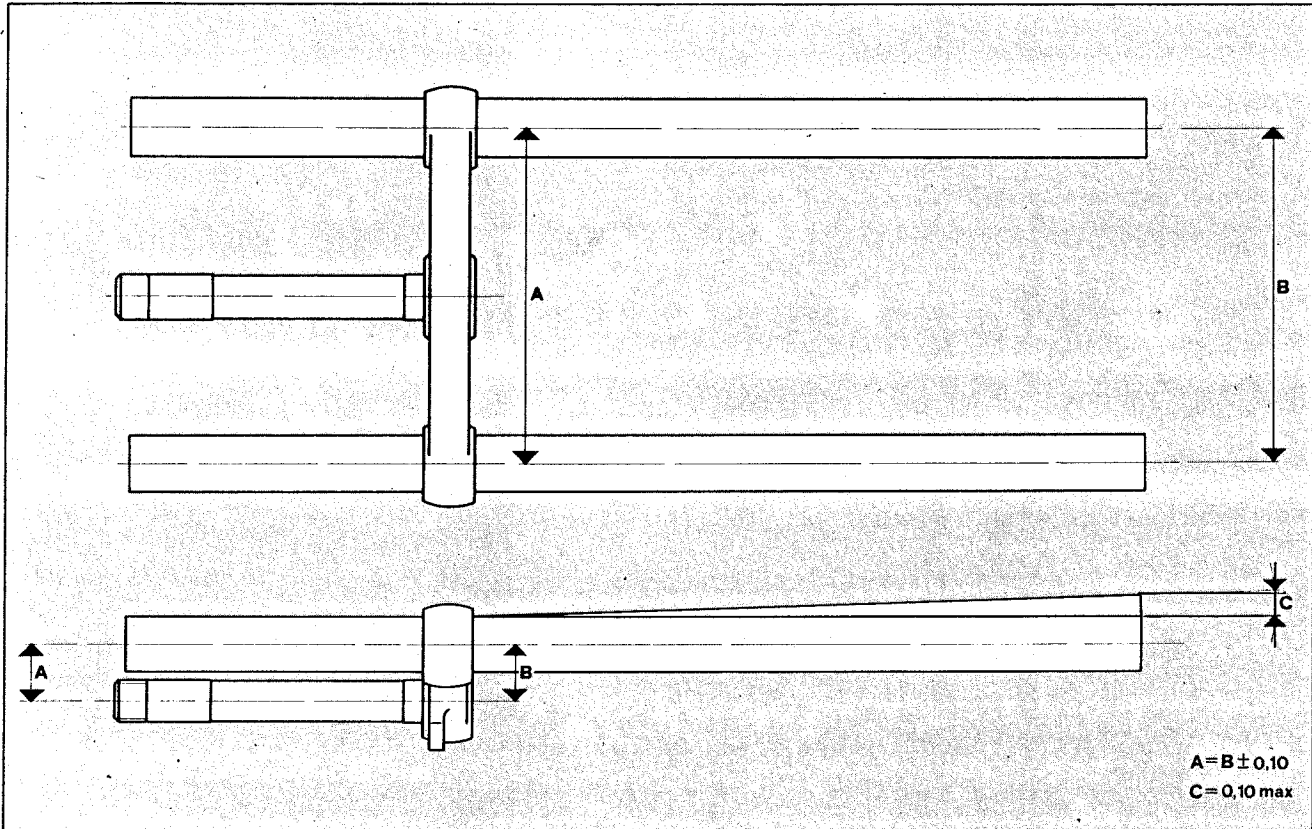
Inspect the oil seal and dust seal for any signs of deterioration or damage, and replace them if necessary.

Replace the oil seal with a new one whenever if has been removed.





SUSPENSIONS AND WHEELS



Inner tube.

A bent, dented, scored or otherwise damaged inner tube will damage the oil seal, causing oil leakage. A badly bent inner tube may cause poor handling.

Inner tube damage.

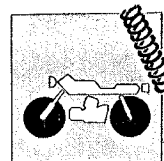
Visually inspect the inner tube, and repair any damage. If the damage is not repairable, replace the inner tube. Since damage to the inner tube damages the oil seal, replace the oil seal whenever the inner tube is repaired or replaced. Temporarily assemble the inner and outer tubes, and pump them back and forth manually to check for smooth operation.

CAUTION

- * If the inner tube is bent or badly creased, replace it. Excessive bending, followed by subsequent straightening, can weaken the inner tube.

To check inner tube bending, install both inner tubes in lower triple clamp and check for distances:

$$A = B \pm 0.10 \quad (A = B \pm 0.0039 \text{ in}).$$

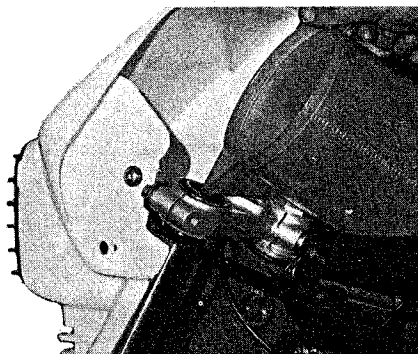
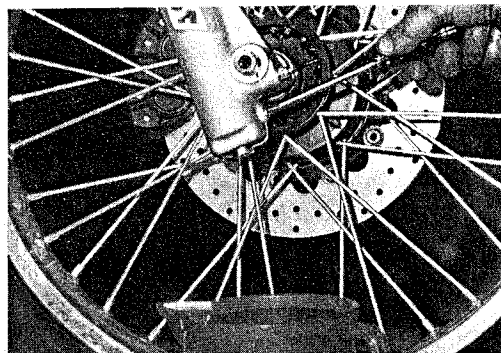


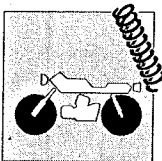
Oil change.

- Place motorcycle on a center stand.
- Remove the handle bar off the stem head.
- Remove the drain screw from the lower end of the outer tube.
- Pump out the oil by repeatedly compressing and extending the front fork.
- Wash the drain screws and place them on the outer tube. Tighten screws.
- Place a jack or stand under the engine so taht the front wheels is raised off the ground.
- Remove the top fork caps and pour in the type and amount of oil specified in table.
- Install fork caps and tight.
- Install the handlebar.
- Remove jack from under the engine.

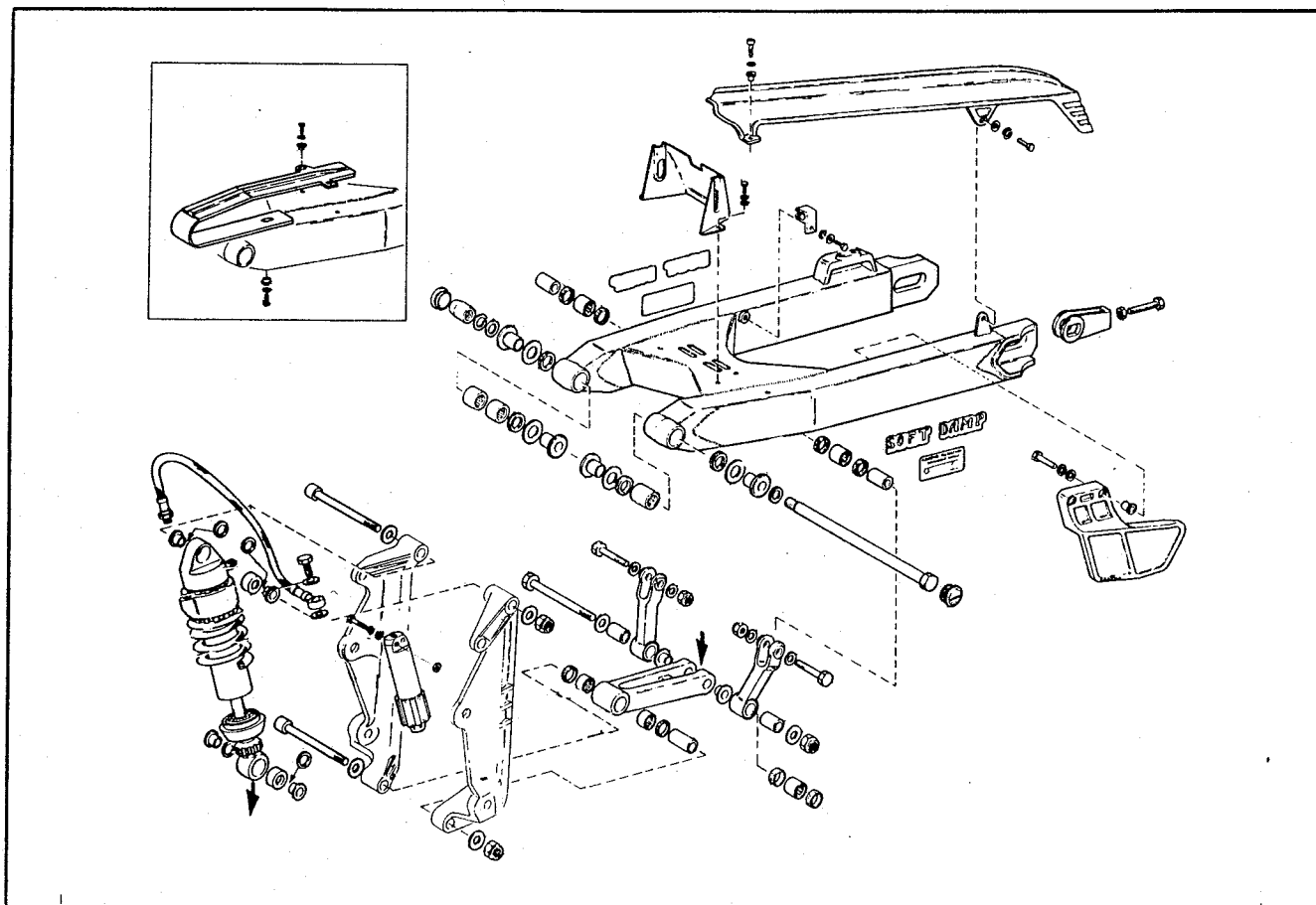
Fork oil : 500 cc or 30.5 cu-in per fork leg.

Oil type: **SAE 15** fork oil.





SUSPENSIONS AND WHEELS



Rear suspension.

The rear suspension is the Cagiva "Soft Damp" system, and it is of the swingarm type controlled by a single shock absorber.

The shock absorber is pressurized and has a hydraulic spring adjuster, so that the spring can be adjusted for different road and loading conditions.

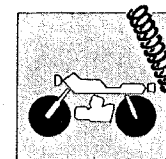
WARNING

This shock absorber contains highly compressed nitrogen gas. Read and understand the following information before handling the shock absorbers. The manufacturer cannot be held responsible for property damage or personal injury that may result from improper handling.

Do not tamper or attempt to open the cylinder assembly.

Do not subject shock absorber to an open flame or other high heat. This may cause the unit to explode due to excessive gas pressure.

Do not deform or damage the cylinder in any way. Cylinder damage will result in poor damping performance.

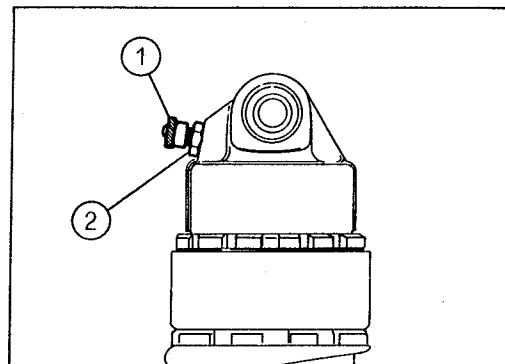


Shock absorber disposal steps

- Remove valve cap 1 .
- Release gas pressure by acting on air valve 2 .

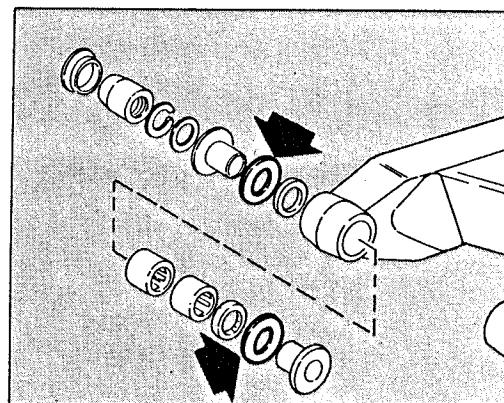
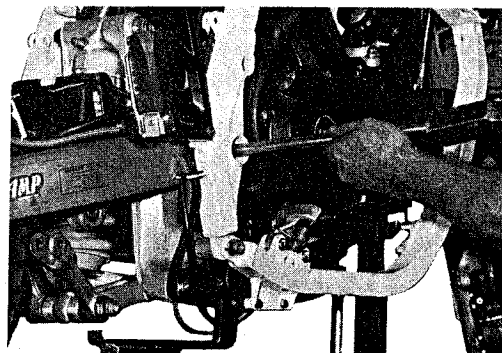
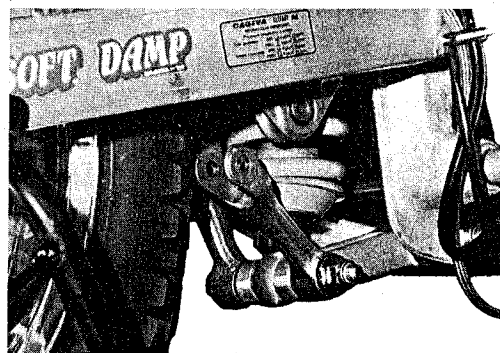
CAUTION

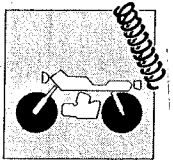
* Wear eye protection to prevent eye damage from escaping gas.



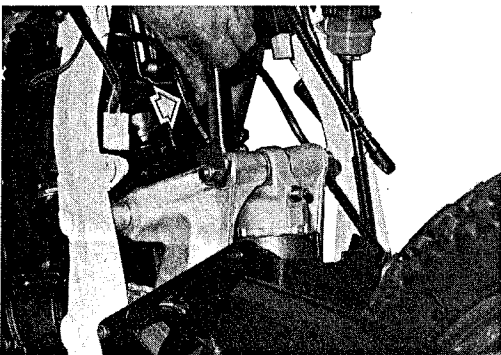
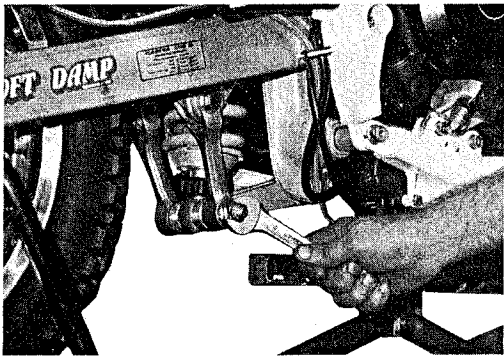
Swingarm.

- Place motorcycle on a center stand and remove rear wheel and shock absorber connecting rods to swingarm.
- Remove swingarm nut and pivot bolt by means of a hammer and a drift pin.
- Remove swingarm.
- Check needle bearings and pivot bolt runout.
- When reassembling check side play of swingarm, if necessary add or remove shims internally or externally.
- Lubricate oil seals lips and bearings with grease.



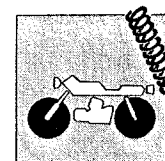


SUSPENSIONS AND WHEELS



Shock absorber removal:

- Place motorcycle on a center stand.
- Remove shock absorber bottom nut and bolt.
- Remove rear subframe as indicated in page E-4.
- Remove shock absorber bottom nut and bolt.
- Remove hydraulic spring preload adjuster from frame.
- Remove shock absorber top fixing nut and bolt.
- Remove shock absorber.



Wheels/tires.

The tires are designed to provide good traction and power transmission during acceleration and braking even on bad surfaces. To do this, they must be inflated to the correct pressure and not overloaded.

If the tires are inflated to too high a pressure, the ride is tough, the center portion of the tread wears quickly, and the tires are easily damaged.

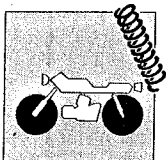
If inflation pressure is too low, the shoulder portions wear quickly, the cord suffers damage, fuel consumption is high and handling is poor. In addition, heat builds up at high speeds, and tire life is greatly shortened.

		Front	Rear
Cold tire pressures PSI (Kg/cm)	Tire Size	90/90 S 21" (*)	130/90 S 17" (*)
		90/90-21-54S(•)	130/80 17-65 (•)
	1 or 2 Persons	25.6 (1.8)	28.4 (2.0)
	2 Persons	25.6 (1.8)	31.3 (2.2)
PIRELLI (*)		MT 40	MT 40
METZELER (•)		ENDURO	ENDURO

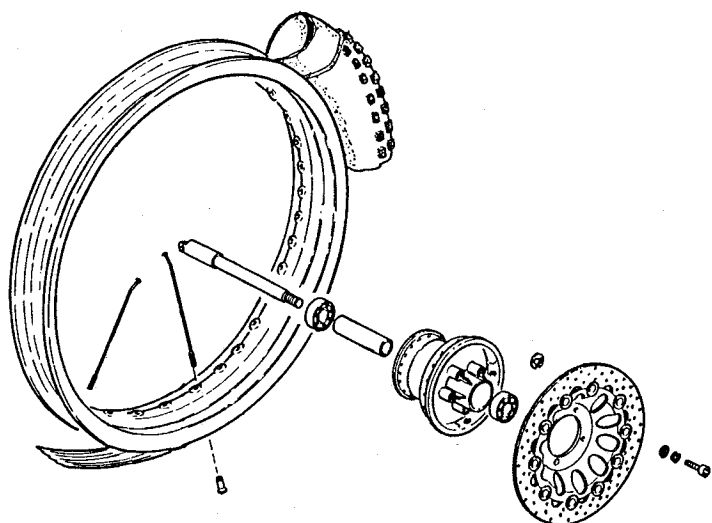
WARNING

- * Operation with excessively worn tires is hazardous and will adversely affect traction and handling.
- * Proper wheel balance is necessary for safe, stable handling of the motorcycle. Wheel balancing is necessary after tire repair or replacement.
- * When replacing tires, mount new tire in the position indicated by arrow for proper rotation.
- * Maximum inflation pressure must not exceed specification located on tire side wall.
- * If a tire shows crosswise lines, it means that the tire is worn to its limit. Tire must be replaced immediately.
- * Never clean, or lubricate either tires, tubes or rims with gasoline or oil because they will cause deterioration of the tire.

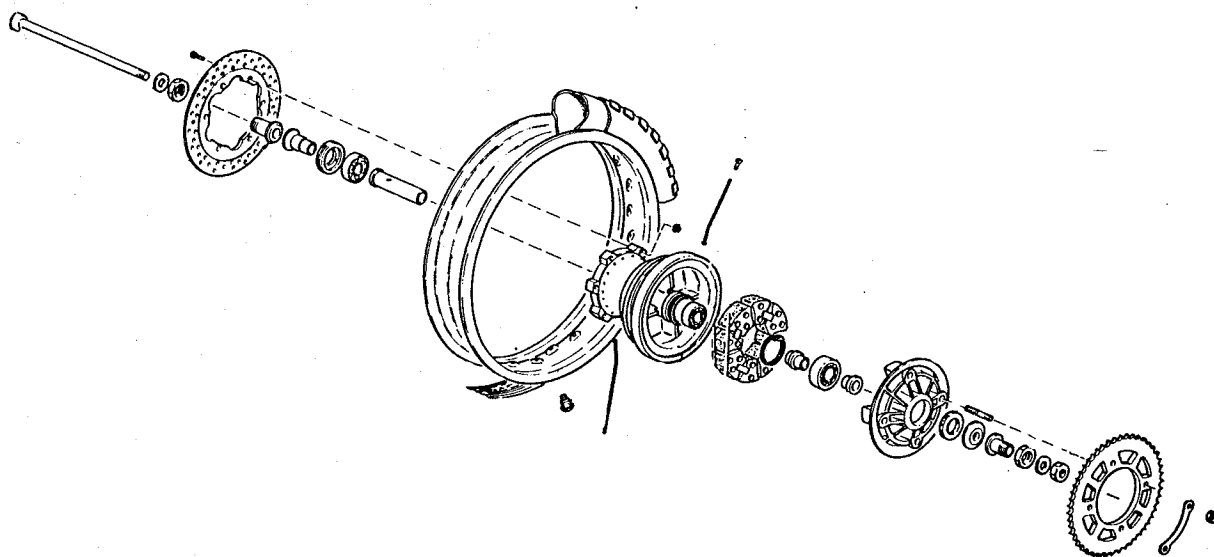




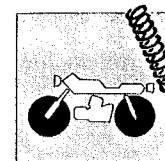
SUSPENSIONS AND WHEELS



Front wheel



Rear wheel



Wheel rim.

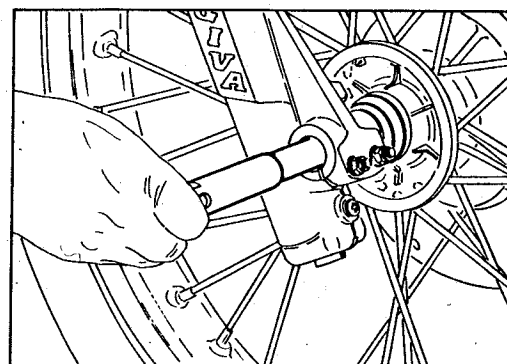
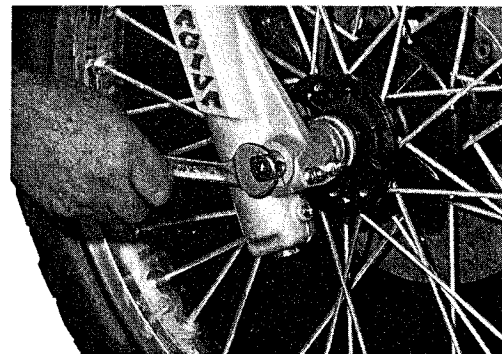
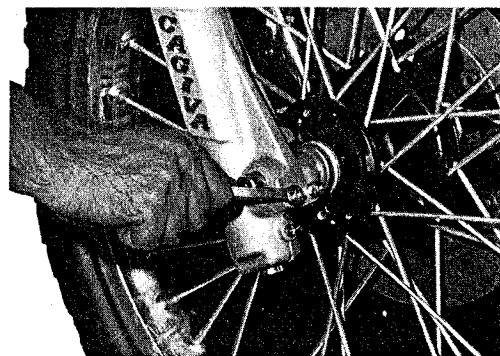
- Wheel rim are of a light alloy material.
- If there is any doubt as to the condition of the wheel, or if the wheel has received a heavy impact, check the rim runout.
- Carefully inspect the rim for small cracks, dents, bents or warp. If there is any damage to the rim, it must be replaced.

Rim sizes: Front: 1.85x21"

Rear : 2.75x17"

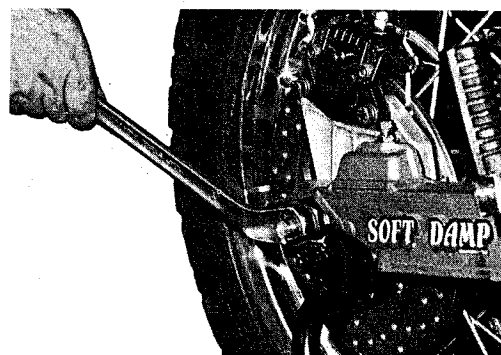
Front wheel removal.

- Loose front wheel axle nut.
- Loose front fork bottom bolts.
- Place a jack or a stand under the engine so that the front wheel is raised off the ground.
- Remove front wheel axle.
- Remove front wheel.
- Remove disc brake if necessary to replace wheel bearings.



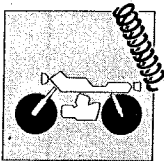
Rear wheel removal.

- Place motorcycle on a center stand.
- Remove driving chain.
- Loosen rear wheel axle nut.
- Remove rear wheel axle.
- Remove disc brake if it is necessary to replace wheel bearings.



CAUTION

- * Do not lay the wheel on the ground with the disc facing down. This can damage or warp the disc. Place blocks under the wheel so the disc does not touch the ground.

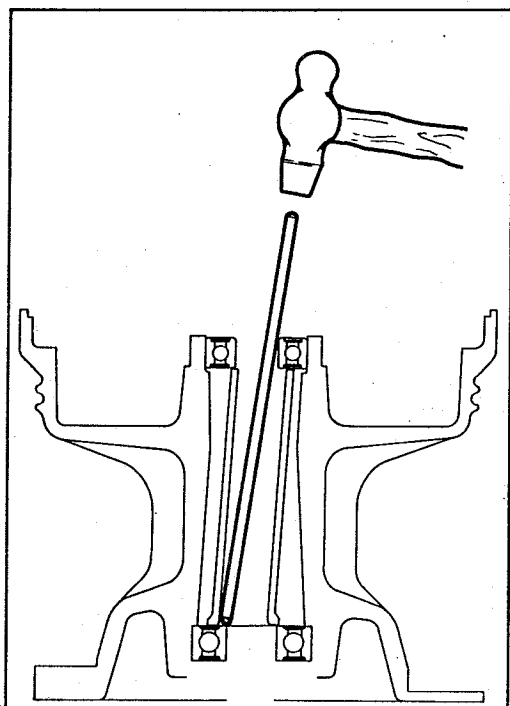


SUSPENSIONS AND WHEELS

Wheel bearings.

A wheel bearing is fitted in both sides of hub.

Since worn wheel bearings will cause play in the wheel, vibration, and instability, they should be changed.



Bearing replacement

- Insert a metal rod into the hub from the top side and remove the bottom side bearing by tapping evenly around the bearing inner race.
- Remove the remaining bearing by tapping evenly around the bearing inner race.

Wheel bearings Installation

- Before installing the new bearings, blow any dirt or foreign particles out of the hub with compressed air to prevent contamination of the bearings.
- Install them using the bearing driver so that the bearings are placed perfectly in axis with wheel axle.



J

- J.1 Hydraulic clutch description
- J.2 Hydraulic clutch fluid drain
- J.2 Master cylinder overhaul
- J.3 Fluid change
- J.3 Bleeding

Hydraulic clutch.

The Elephant 650 has a hydraulically operated clutch. The clutch system has to be inspected periodically for fluid level and leakage.

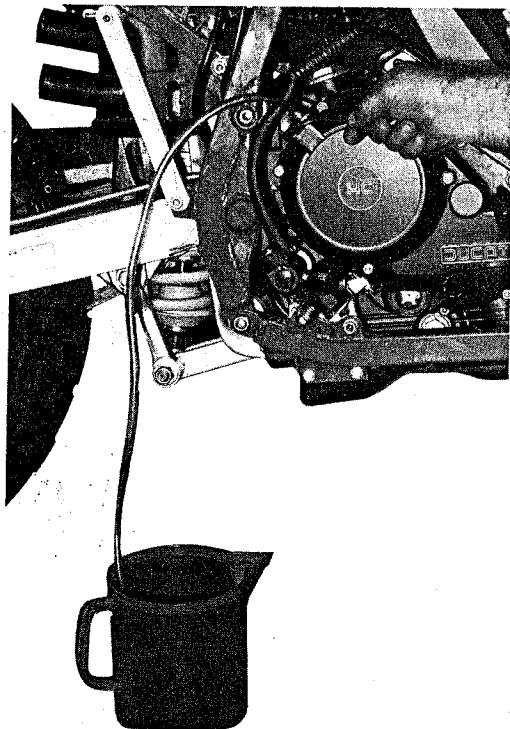
The hydraulic clutch system is composed of the following parts:

- Master cylinder with fluid reservoir and clutch lever, placed on handlebar.
- Hydraulic line.
- Clutch piston, placed on clutch cover.





HYDRAULIC CONTROL CLUTCH RELEASE

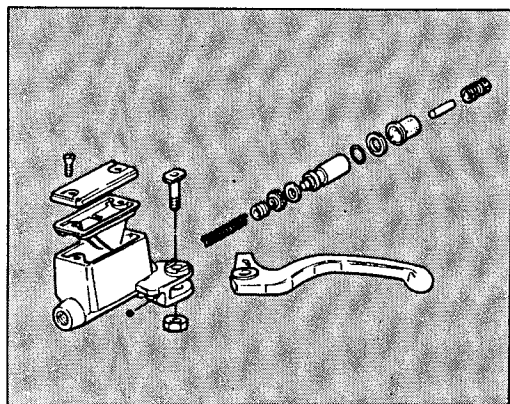


Hydraulic clutch fluid drain.

- Attach a clear plastic hose into the bleed valve on clutch cover and turn the other end inside a container.
- Loosen bleed valve so fluid begins to drain.
- Remove container cap and rubber diaphragm.

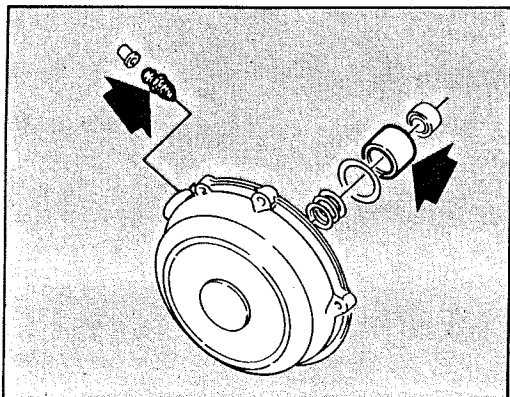
WARNING

- * Since the hydraulic clutch fluid is brake fluid, it may cause irritation. Avoid contact with skin or eyes. In case of contact, flush thoroughly with water and call a doctor if your eyes were exposed.



Hydraulic clutch master cylinder overhaul.

- Check that piston and cylinder surfaces are perfectly smooth.
- Replace seals if necessary.
- Clean thoroughly.



Hydraulic clutch piston overhaul

- Check that piston and cylinder surfaces are perfectly smooth.
- Replace seals if necessary.
- Clean thoroughly.

**Changein the clutch fluid.**

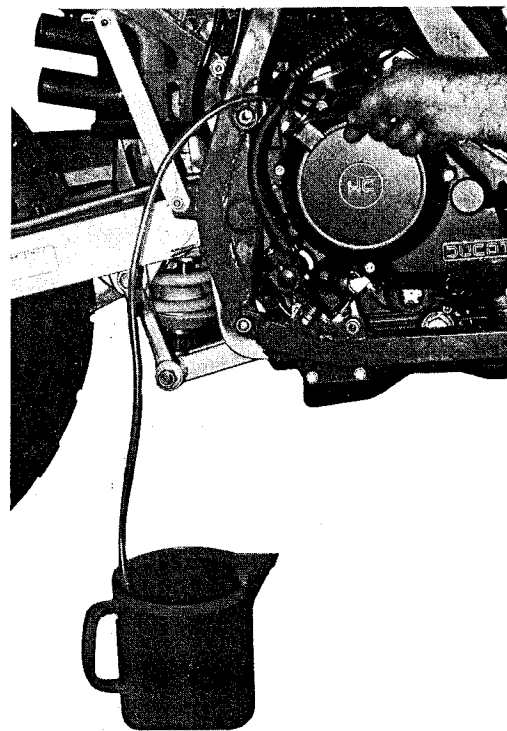
The clutch fluid should be checked and changed in accordance with the Periodic Maintenance Chart and whenever becomes contaminated with dirt or water.

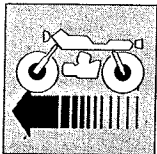
CAUTION

- * Use only DOT 4 brake fluid from a sealed container.
- * Handle brake fluid with care because it can damage paint and instrument lenses.
- * Never allow contaminants (dirt, water, etc. ...) to enter the brake fluid reservoir.

Bleeding the clutch.

- Attach a clear plastic hose to the bleed valve on the clutch cover, and run the other end of the hose into a container.
- Remove the reservoir cap, and the rubber cap.
- Fill up master cylinder reservoir with brake fluid.
- Open the bleed valve (counterclockwise to open), apply the clutch by the lever, close the valve with the clutch held applied, and then quickly release the lever. Repeat this operation until clutch line is filled and fluid starts coming out the plastic hose. Replenish the fluid in the reservoir as often as necessary to keep it from running completely out.
- When pulling the clutch lever becomes hard, repeat operation until the clear plastic hose is free of air bubbles.





BRAKES

L

- L.1 Brake system
- L.2 Brake pads removal
- L.3 Brake disc
- L.3 Brake fluid drain
- L.4 Caliper overhaul
- L.5 Brake master cylinder overhaul
- L.6 Fluid change
- L.6 Bleeding the brake

Brake system.

A hydraulic disc brake is used on each wheel for superior braking performance and high reliability. The major components of each disc brake are the brake lever (front) or the brake pedal (rear), master cylinder, brakeline, caliper assembly, and disc.

The brake lever is pulled or the brake pedal is pushed to move a piston in the master cylinder and pressurize the brake fluid.

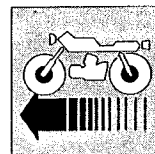
Fluid pressure is transmitted through the brake line to operate the caliper. The caliper grips the disc attached to the wheel, slowing wheel rotation. Front brake light switch is actioned by the lever and it is placed in master cylinder bracket. Rear brake light switch is hydraulic pressure actioned and is placed in the rear master cylinder.

Each switch turns on the brake light.

Due to the fact that the components of the disc brake, the disc and pads, are in direct contact with the air flow past the motorcycle, excellent dissipation of the heat from brake friction is obtained, and minimizes the possibility of brake fade common to drum brakes.

The automatic wear adjustment mechanism of the rear caliper is the same of the front caliper, and caliper operation is the same as for the front caliper.





Brake pads removal.

- Remove the guard cap.
- Remove pads pin holder.
- Remove the pads.

Pad wear.

- Inspect the pads for wear.
- Service limit: 4 mm (0.16 in).

Pad cleaning.

Be careful that no disc brake fluid or any oil gets on them. Clean off any fluid or oil that inadvertently gets on the pads or disc with a high flash-point solvent. Replace the pads with new ones if they cannot be cleaned satisfactorily.

Pad installation.

- If a new thicker pad is installed, push the caliper pistons in their housings by means of a soft end tool.

Note: Do not use hard surface tools, they could cause damage in brake pistons and resault in hazardous braking situations.

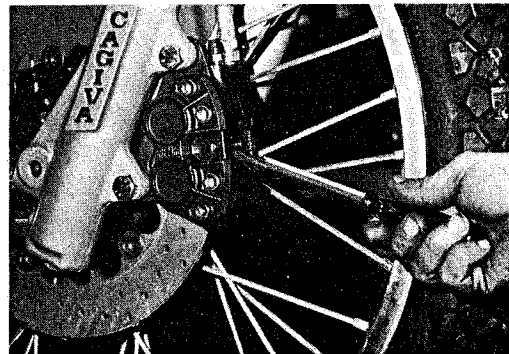
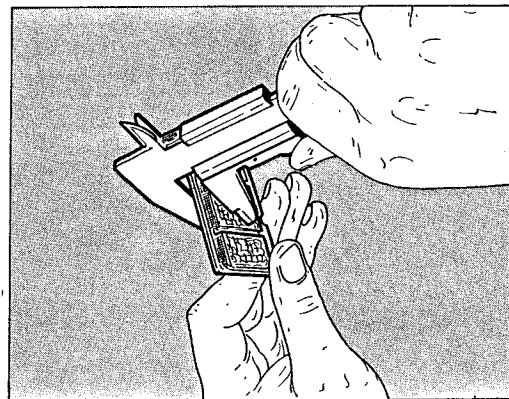
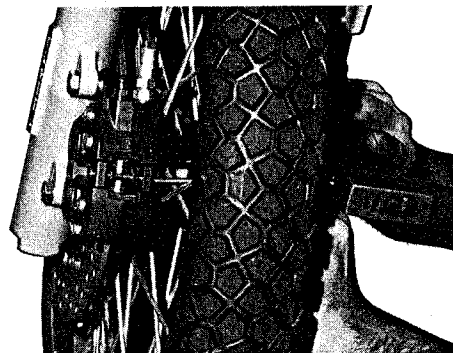
- Install new brake pads.
- Install anti-rattle spring blade and holder pin.
- Bleed the brake if required.
- Pump lever and/or pedal until brake pads are against the disc.
- Check the brake.
- Install the guard cap.

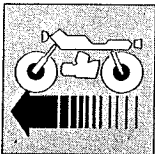
CAUTION

- * New pads require a minimum break-in distance of 95 Kms (60 miles).

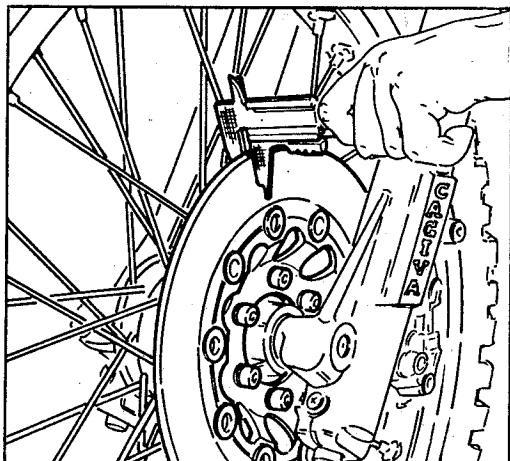
WARNING

- * Do not attempt to drive the motorcycle until a full brake lever or pedal is obtained by pumping the brake lever or pedal until the pads are against the disc. The brake will not function on the first application of the lever or pedal if this is done.





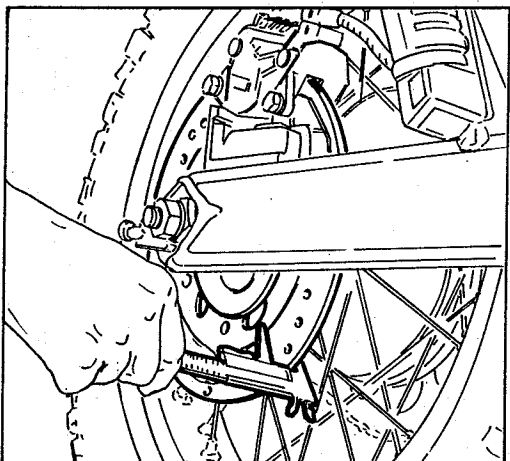
BRAKES



Brake disc wear.

Measure the thickness of each disc at the point where it has worn the most. Replace the disc if it has worn past the service limit.

Front and rear disc service limit: 5.8 mm (0.2283 in).



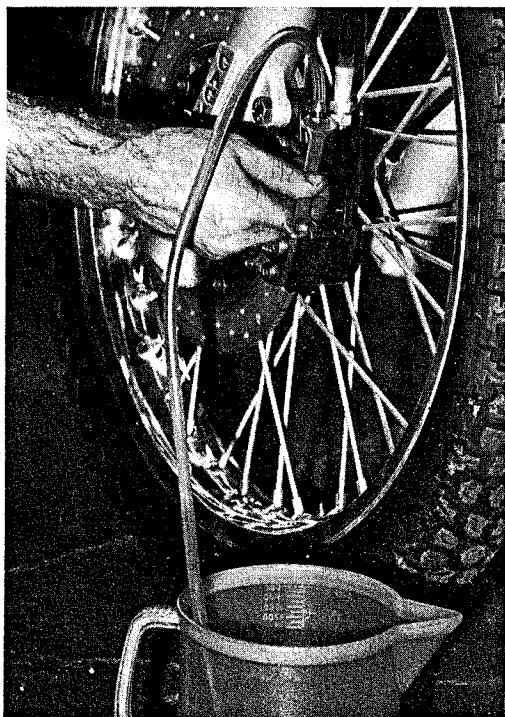
Disc cleaning.

Poor braking can also be caused by oil on the disc.

Oil or grease on the disc must be cleaned off with trichloroethylene or a high flash-point solvent.

Do not use on which will leave on oily residue.

Note: Be sure that cooling holes of discs are clean.

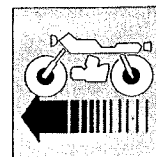


Brake fluid drain.

- Attach a clear plastic hose to the bleed valve on the caliper and turn the other end of the hose into a container.
- Loosen bleed valve so fluid begins to drain.
- Remove container cap and rubber diaphragm.
- Pump with lever/pedal brake to push brake fluid out of the line.

WARNING

- * Brake fluid quickly ruins painted surfaces; any spilled fluid should be completely wiped up immediately.
- * Brake fluid may cause irritation. Avoid contact with skin or eyes. In case of contact, flush thoroughly with water and call a doctor if your eyes were exposed.



Caliper overhaul.

- Remove fluid hose.
- Remove caliper from support.
- Dissasamble caliper by removing the allen bolts.
- Clean thoroughly.

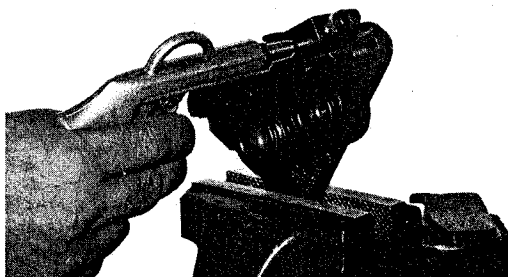
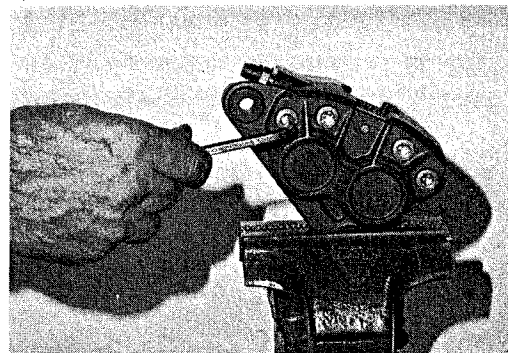
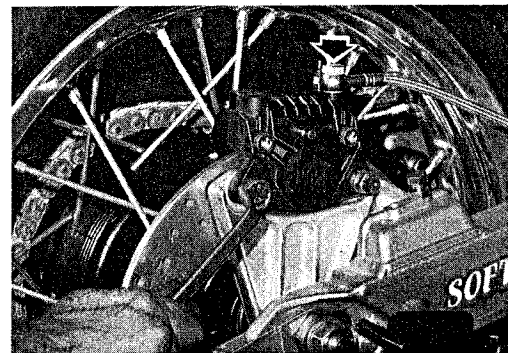
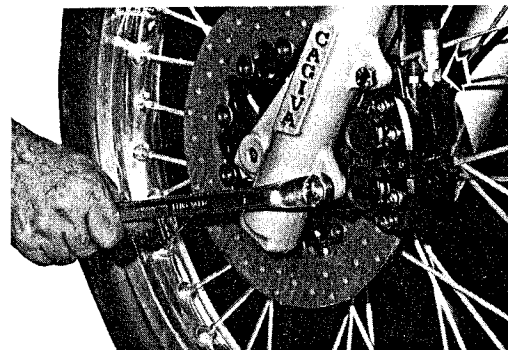
CAUTION

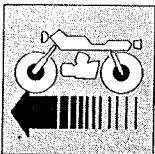
- * To clean calipers, use only isopropyl alcohol, or ethyl alcohol. Gasoline, motor oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely and will eventually reach and break down the rubber used in the disc brake.

- Use aire compressed to remove pistons.
- Check that piston and cylinder surfaces are perfectly smooth.
- Reassemble.

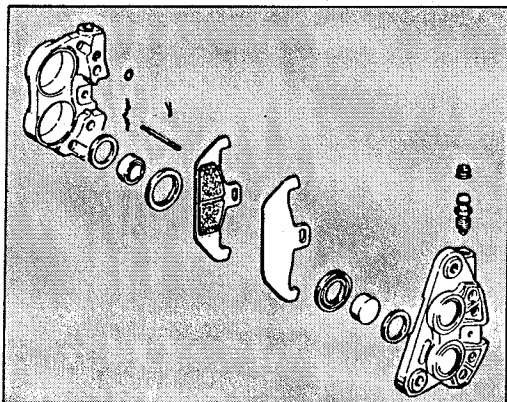
WARNING

- * Compressed air can possibly forcibly eject the pistons from the calipers. Rap a shop towel around the caliper before applying compressed air.





BRAKES

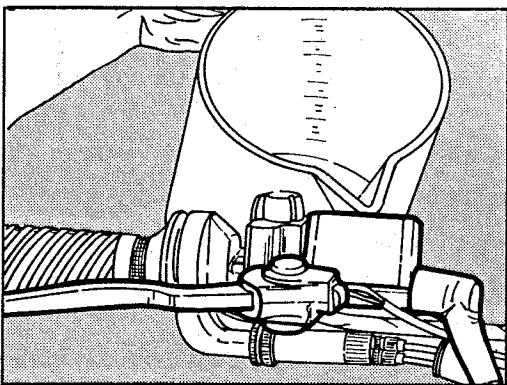


Mastercylinder overhaul.

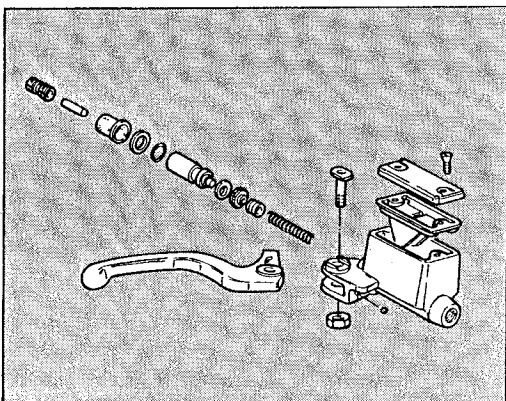
- Push piston with a thin rod to relieve pressure from snap ring.
- Remove snap ring.
- Slowly pull out rod until piston comes out of master cylinder pushed by internal spring.
- Clean thoroughly.

CAUTION

- * To clean master cylinders and pistons, use only isopropyl alcohol, or ethyl alcohol. Gasoline, motor oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely and will eventually reach and break down the rubber used in piston, or disc brake.



- Check that piston and master cylinder surfaces are perfectly smooth.
- Reassemble.



Fluid change.

The brake fluid should be checked and changed in accordance with the Periodic Maintenance Chart and whenever becomes contaminated with dirt or water.

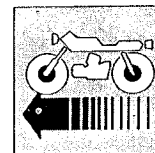
Don't change the fluid in the rain or when a strong wind is blowing.

CAUTION

- * Use only DOT 4 brake fluid from a sealed container. Never use old brake fluid.
- * Never allow contaminants (dirt, water, etc. ...) to enter the brake fluid reservoir.
- * Handle brake fluid with care because it can damage paint and instrument lenses.
- * Don't leave the reservoir cap off for any length of time to avoid moisture contamination of the fluid.

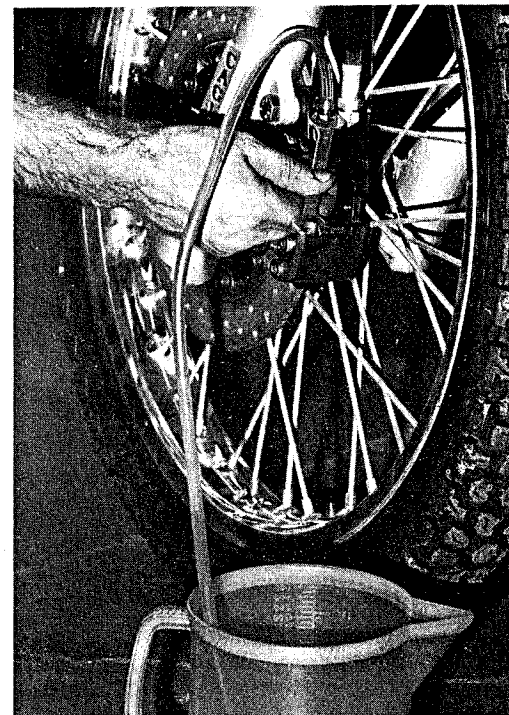
WARNING

- * Do not mix two types of fluid for use in the brake. This lowers the brake fluid boiling point and could cause the brake to be ineffective it may also cause the rubber brake parts to deteriorate.



Refilling the brake lines.

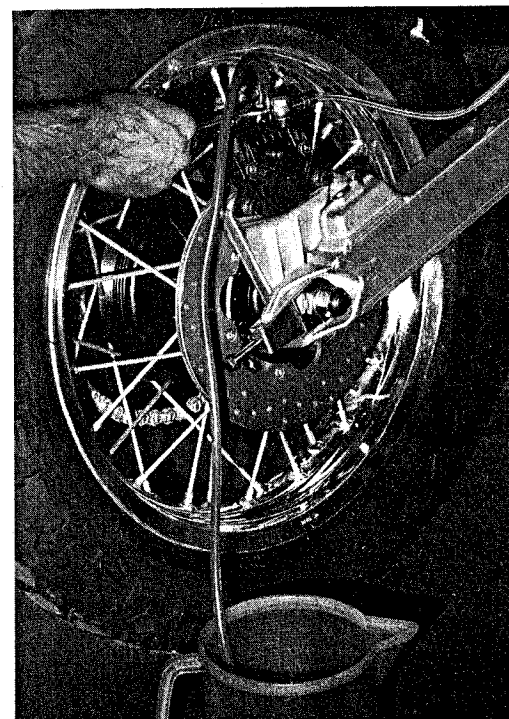
- Attach a clear plastic hose to the bleed valve on the caliper, and run the other end of the hose into a container.
- Remove the reservoir cap, and remove the rubber cap on the bleed valve.
- Open the bleed valve (counterclockwise to open), and pump the brake lever or pedal until all the fluid is drained from the line.
- Close the bleed valve, and fill the reservoir with fresh brake fluid.
- Open the bleed valve, apply the brake by the brake pedal or lever, close the valve with the brake held applied, and then quickly release the lever or pedal. Repeat this operation until the brake line is filled and fluid starts coming out of the plastic hose. Replenish the fluid in the reservoir as often as necessary to keep it from running completely out.

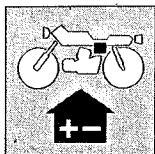


Bleeding the brakes.

If the brake fluid has just been changed or the lever or pedal feels soft or spongy, air has entered the brake lines and has to be removed.

- Remove the reservoir cap and check that there is plenty of fluid in the reservoir. The fluid level must be checked several times during the bleeding operation and replenish as necessary. If the fluid in the Reservoir runs completely out any time during bleeding, the bleeding operation must be done over again from the beginning since air will have entered the line.
- With the reservoir cap off, slowly pump the brake lever or pedal several times until no air bubbles can be seen rising up through the fluid from the holes at the bottom of the reservoir. This bleeds the air from the master cylinder end of the line.
- Install the reservoir cap, and connect a clear plastic hose to the bleed valve at the caliper, running the other end of the hose into a container. Pump the brake lever or pedal a few times until it becomes hard and then, holding the lever squeezed or the pedal pushed down, quickly open (turn counterclockwise) and close the bleed valve. Then release the lever or pedal. Repeat this operation until no more air can be seen coming out into the plastic hose. Check the fluid level in the reservoir every so often, replenishing it as necessary.
- When air bleeding is finished, check that the brake fluid is filled to the upper level line marked in the reservoir.





ELECTRIC SYSTEM

M

- M.2 Wiring Diagram
- M.3 Ignition system wiring diagram
- M.4 Battery
- M.6 Generator
- M.6 Fuse box
- M.7 Regulator rectifier
- M.7 Ignition coil test
- M.7 Pick-up test
- M.8 Spark plugs
- M.8 Spark plug caps
- M.8 Start
- M.9 Ignition timing advance inspection

Wire color codes

POS.	COLOUR	POS.	COLOUR	POS.	COLOUR	POS.	COLOUR	POS.	COLOUR	POS.	COLOUR
1	BLUE	12	GREEN-BLACK	23	YELLOW	34	WHITE-BROWN	45	RED	56	BLUE
2	BLUE	13	ORANGE	24	GREY	35	WHITE-BLACK	46	GREEN-BLACK	57	GREEN-BLACK
3	BLUE	14	L.T. BLUE	25	BLUE-BLACK	36	WHITE-L.T. BLUE	47	GREEN-BLACK	58	GREY
4	BLUE	15	RED-BLACK	26	WHITE-RED	37	WHITE-VIOLET	48	RED	59	RED
5	BLUE	16	YELLOW-BLACK	27	WHITE-RED	38	BLUE-ORANGE	49	RED	60	YELLOW
6	RED	17	YELLOW-BLACK	28	YELLOW-RED	39	ORANGE-BLACK	50	BROWN	61	YELLOW
7	RED	18	YELLOW-BLACK	29	GREEN	40	RED-GREEN	51	GREEN-BLACK	62	WHITE-BLACK
8	BROWN	19	WHITE	30	GREEN	41	YELLOW-GREEN	52	—	63	GREY
9	GREEN-BLACK	20	WHITE	31	YELLOW-GREEN	42	YELLOW-GREEN	53	—		
10	GREEN-BLACK	21	BLACK	32	PINK	43	BLUE	54	RED		
11	GREEN-BLACK	22	YELLOW	33	WHITE-BLUE	44	BLUE	55	WHITE-RED		

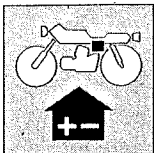
THE ELECTRIC DIAGRAM

Fuses Key

Fuse	Rating
F1	15 Amp.
F2	15 Amp.
F3	25 Amp.
F4	25 Amp.

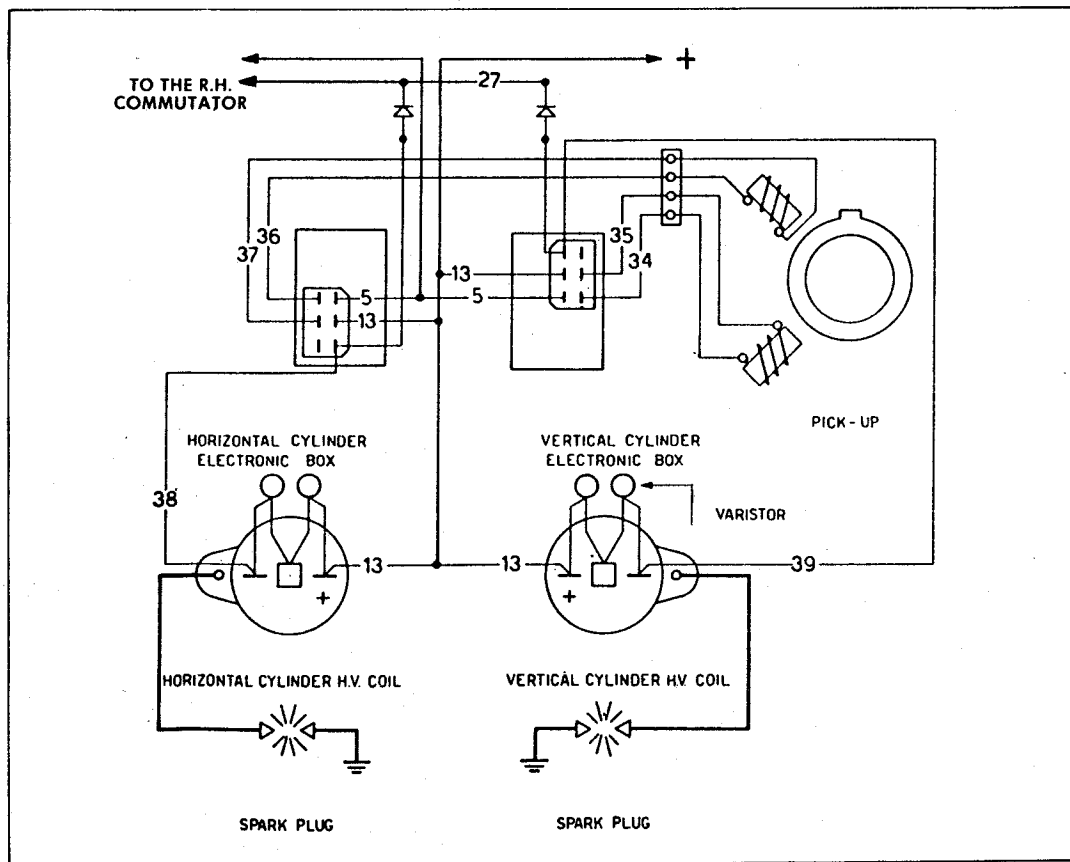
Diagram Labels:

- BATTERIA BATTERY
- INTER PRESS OILO OIL PRESSURE SWITCH
- STOP POST REAR STOPLIGHT
- INTER FOLLE NEUTRAL SWITCH
- ALTERNATORE ALTERNATOR
- INDICATORE DIREZ. DEX. TURN SIGNAL RIGHT
- INDICATORE DIREZ. SIN. TURN SIGNAL LEFT
- FANALINO POST. TAIL LIGHT
- INDICATORE DIREZ. SIN. TURN SIGNAL LEFT
- ILLUM. STRUM. STRAIGHT'S LIGHTS
- COMMUTATORE SIN. LEFT COMMUTATOR
- COMMUTATORE DEX. RIGHT COMMUTATOR
- INTER. A CHIAVE IGNITION SWITCH
- TELELUTTORE AVV. SOLENOID STARTER
- MOTORINO AVV. STARTING MOTOR
- REGOLATORE REGULATOR
- FUSIBILI FUSES
- STOP ANT. FRONT STOPLIGHT
- INTERMITT. FRECCO TURN SIGNAL FLASHER
- CENTRALI FRECCO CENTRAL FLASHER
- CENTRALI ELETTRICI CENTRAL ELECTRIC
- BOBINA AT. CIL. ORIZZ. HORIZONTAL CYLINDER HV COIL
- BOBINA AT. CIL. VERT. VERTICAL CYLINDER HV COIL
- CANDELA SPARK PLUG
- AVV. ACUSTICO HORN
- PROIETTORE ANT. HEADLAMP



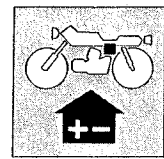
ELECTRIC SYSTEM

Ignition system wiring diagram



Wire color codes

POS.	COLOUR	POS.	COLOUR	POS.	COLOUR	POS.	COLOUR	POS.	COLOUR	POS.	COLOUR
1	BLUE	12	GREEN-BLACK	23	YELLOW	34	WHITE-BROWN	45	RED	56	BLUE
2	BLUE	13	ORANGE	24	GREY	35	WHITE-BLACK	46	GREEN-BLACK	57	GREEN-BLACK
3	BLUE	14	L.T. BLUE	25	BLUE-BLACK	36	WHITE-L.T. BLUE	47	GREEN-BLACK	58	GREY
4	BLUE	15	RED-BLACK	26	WHITE-RED	37	WHITE-VIOLET	48	RED	59	RED
5	BLUE	16	YELLOW-BLACK	27	WHITE-RED	38	BLUE-ORANGE	49	RED	60	YELLOW
6	RED	17	YELLOW-BLACK	28	YELLOW-RED	39	ORANGE-BLACK	50	BROWN	61	YELLOW
7	RED	18	YELLOW-BLACK	29	GREEN	40	RED-GREEN	51	GREEN-BLACK	62	WHITE-BLACK
8	BROWN	19	WHITE	30	GREEN	41	YELLOW-GREEN	52	—	63	GREY
9	GREEN-BLACK	20	WHITE	31	YELLOW-GREEN	42	YELLOW-GREEN	53	—		
10	GREEN-BLACK	21	BLACK	32	PINK	43	BLUE	54	RED		
11	GREEN-BLACK	22	YELLOW	33	WHITE-BLUE	44	BLUE	55	WHITE-RED		



Battery.

The battery supplies the current to the starter motor and serves as a back-up source of power to operate the electrical equipment whenever the engine is turning over too slowly for the alternator to supply sufficient power. With proper care, the battery can be expected to last several years, but it may be completely ruined long before that if it is mistreated. Following a few simple rules will greatly extend the life of the battery.

1. When the level of the electrolyte in the battery is low, add only distilled water to each cell, until the level is at the upper level line marked on the outside of the battery. Ordinary tap water is not a substitute for distilled water and will shorten the life of the battery.
2. Never add sulphuric acid solution to the battery. This will make the electrolyte solution too strong and will ruin the battery within a very short time.
3. Avoid quick-charging the battery. A quick-charge will damage the battery plates.
4. Never let a good battery stand for more than 30 days without giving it a supplemental charge, and never let a discharged battery stand without charging it. If a battery stands for any length of time, it slowly self-discharges. Once it is discharged, the plates sulphate (turn white), and the battery will no longer take a charge.
5. Keep the battery well charged during cold weather so that the electrolyte does not freeze and crack open the battery. The more discharged the battery becomes, the more easily it freezes.
6. Always keep the battery vent hose free of obstruction, and make sure it does not get pinched, crimped, or melted shut by contact with the hot muffler. If battery gases cannot escape through this hose, they will explode the battery.
7. **DON'T INSTALL THE BATTERY BACKWARDS.** The negative side is grounded.

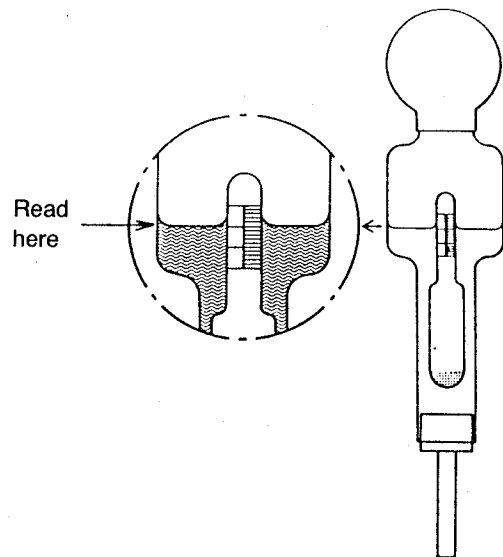
Electrolyte.

The electrolyte is dilute sulphuric acid. The standard specific gravity of the electrolyte is 1.280 at 20°C (68°F). The water in this solution changes to a gaseous mixture due to chemical action in the battery and escapes, which concentrates the acid in a charged battery. Consequently, when the level of the electrolyte becomes low, only distilled water should be added. If sulphuric acid is added, the solution will become too strong for proper chemical action and will damage the plates. Metal from the damaged plates collects in the bottom of the battery. This sediment will eventually cause an internal short circuit.

The specific gravity of the electrolyte is measured with a hydrometer and is the most accurate indication of the condition of the battery. When using the hydrometer, read the electrolyte level at the bottom of the meniscus (curved surface of the fluid). Fig. K2 shows the relationship between the specific gravity of the solution at 20°C (68°F) and the percentage of battery charge. Since specific gravity varies with temperature, and since the temperature of the solution being checked is likely to be other than 20°C (68°F); the formula given below should be used to compute the equivalent specific gravity for any temperature. When the temperature goes up, the specific gravity goes down, and vice versa.

Hydrometer

K1



° Celsius

$$S_{20} = S_t + [0.0007 (t - 20)]$$

° Fahrenheit

$$S_{68} = S_t + [0.0004 (t - 68)]$$

S_t = specific gravity at the present temperature

S_{20} = specific gravity at 20°C

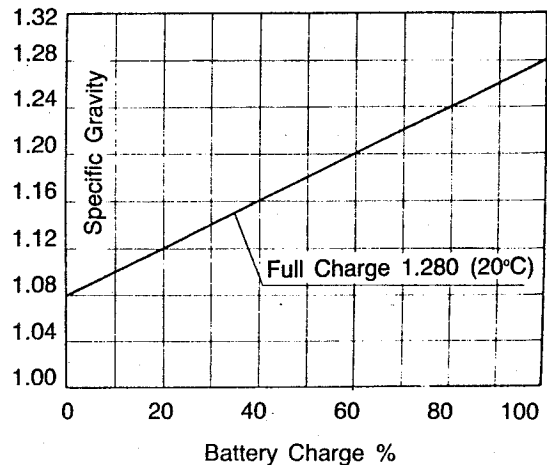
S_{68} = specific gravity at 68°F

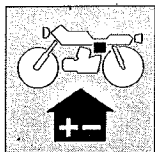
t = present temperature of solution

Generally speaking, a battery should be charged if a specific gravity reading shows it to be discharged to 50% or less of full charge.

Specific Gravity / Battery Charge Relationship

K2





ELECTRIC SYSTEM

Initial charge.

New batteries for **CAGIVA** motorcycles are dry charged and can be used directly after adding the electrolyte. However, the effect of the dry charge deteriorates somewhat during storage, especially if any air has entered the battery from imperfect sealing.

Therefore, it is best to give the battery an initial charge before using it in order to ensure long battery life.

WARNING

Because the battery gives off an explosive gas mixture of hydrogen and oxygen, keep any sparks or open flame away from the battery during charging.

- Pour a 1.280 (specific gravity at 20°C or 68°F) sulphuric acid solution into each cell of the battery up to the upper level line.
- Let the battery stand for 30 minutes, adding more acid if the level drops during this time.

Note: 1. If the temperature of the solution is over 30°C (85°F), cool the solution before pouring it into the battery.

2. After pouring the acid into the battery, start charging the battery within 12 hours.

- Leaving the caps off the cells, connect the battery to a charger, set the charging rate at 1/10 the battery capacity, and charge it for 10 hours. For example, if the battery is rated at 12AH, the charging rate would be 1.2 ampere. If a constant voltage charger is used, the voltage must be adjusted periodically to keep the current at a constant value.

CAUTION

If the temperature of the electrolyte rises above 45°C (115°F) during charging, reduce the charging rate to bring down the temperature, and increase the charging time proportionately.

- After charging, check the electrolyte level in each cell. If the level has dropped, add distilled water to bring it back up to the upper level line.
- Check the results of charging by measuring the specific gravity of each cell and by measuring battery voltage. Battery voltage of a 12 volt battery directly after the completion of charging should be 15 to 16 volts.

Ordinary charge.

WARNING

Because the battery gives off an explosive gas mixture of hydrogen and oxygen, keep any sparks or open flame away from the battery during charging.

- Clean off the battery using a solution of baking soda and water. Make especially sure that the terminals are clean.
- If the electrolyte level is low in any cell, fill to over the lower level line but not up to the upper level line since the level rises during charging. Figure the charging rate to be between 1/10 and 3/10 of battery capacity. For example, the maximum charging rate for a 12AH battery would be $12 \times 3/10$ which equals 3.6 amperes.

CAUTION

Charging the battery at a rate higher than specified above could ruin the battery. Charging at a higher rate causes excess heat, which can warp the plates and cause internal shorting. Higher than normal charging rates also cause the plates to shed active material. Deposits will accumulate, and can cause internal shorting.

- Measure the specific gravity of the electrolyte, and use the graph, Fig. K2, to determine the percentage of discharge. Multiply the capacity of the battery by the percentage of discharge to find the amount of discharge in ampere-hours. Use this figure in the formula below to compute charging time.

$$\text{Charging time (hours)} = \frac{\text{Amount of discharge (AH)}}{\text{Charging current (A)}} \times 1.2 \sim 1.5$$

- Remove the caps from all the cells, and begin charging the battery at the rate just calculated. If a constant voltage charger is used, the voltage will have to be adjusted periodically to maintain charging current at a constant value.

CAUTION

If the temperature of the electrolyte rises above 45°C (115°F) during charging, reduce the charging rate to bring down the temperature, and increase charging time proportionately.

- After charging, check the electrolyte level in each cell. If the level has dropped, add distilled water to bring it back up to the upper level line.
- Check charging results by measuring the specific gravity of each cell and by measuring battery voltage. Battery voltage of a 12 volt battery directly after the completion of charging should be 15 to 16 volts and the specific gravity of the electrolyte should be more than 1.250. If the voltage is lower than this, the battery is not completely charged or can no longer take a full charge. If the specific gravity of any one cell is lower than 1.250, there may be damage in the cell.

Test charging.

When the battery is suspected of being defective, first inspect the points noted in the table below. The battery can be restored by charging it with the ordinary charge. If it will take a charge so that the voltage and specific gravity come up to normal, it may be considered good except in the following case:

If the voltage suddenly jumps to over 13 volts just after the start of charging, the plates are probably sulphated. A good battery will rise to 12 volts immediately and then gradually go up to 12.5 ~ 13 volts in about 30 to 60 minutes after charging is started.

If one cell produces no gas bubbles, or has a very low specific gravity, it is probably shorted.

If there does not appear to be enough sediment to short the plates, but one cell has a low specific gravity after the battery is fully charged, the trouble may be just that there is insufficient acid in that cell. In this instance only, sulphuric acid solution may be added to correct the specific gravity. If a fully charged battery not in use loses its charge after 2 to 7 days, or if the specific gravity drops markedly, the battery is defective. The self-discharge rate of a good battery is only about 1% per day.

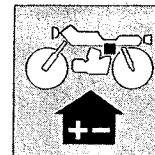


Table K1 - Battery Troubleshooting Guide

	Good Battery	Suspect Battery	Action
Plates	(+) chocolat color (-) gray	white (sulphated) + plates broken or corroded	Replace
Sediment	None, or small amount	sediment up to plates, causing short	Replace
Voltage	above 12 volts	below 12 volts	Test charge
Electrolyte Level	above plates	below top of plates	Fill and test charge
Specific Gravity	above 1.200 in all cells; no two cells more than 0.020 different	below 1.100, or difference of more that 0.020 between two cells	Test charge

Generator.

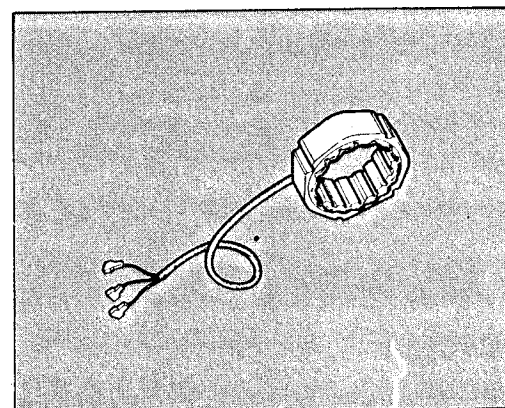
The generator is placed on the left hand side of the engine. The stator coil is mounted in the alternator cover, while the rotor is secured to the left end of the crankshaft and rotates at engine r.p.m.

Permanent magnets in the rotor supply the magnetic field for the stator coil so that no slip rings or brushes are necessary, making the alternator practically maintenance free.

Power out put is: 12 Volts, 300 watts.

CAUTION

- * Do not allow the rotor to suffer sharp impacts such as striking it with a hammer or letting it fall on a hard surface. Such a shock to the rotor can cause the magnets to loss their magnetism.

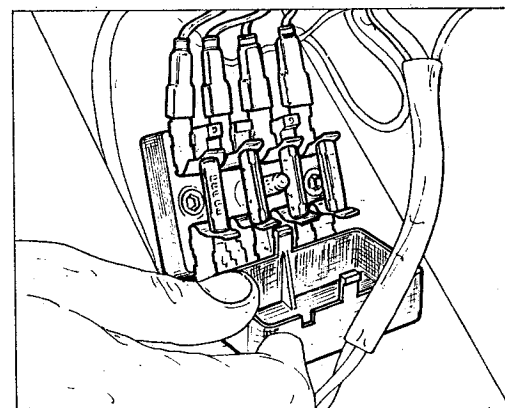
**Fuse box.**

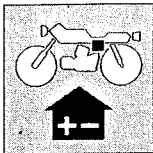
The fuse box is fixed to the left handside of the motorcycle, just besides the battery.

To reach it, remove right side pannel.

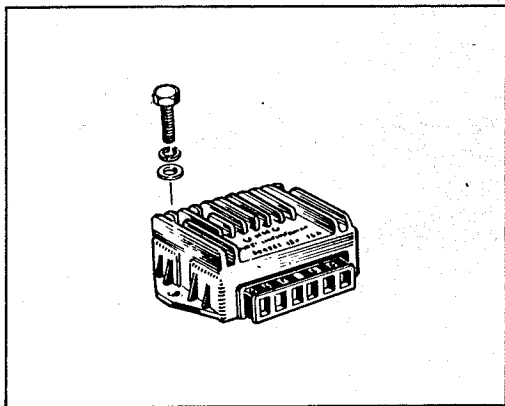
CAUTION

- * Before replacing a damaged fuse look for the cause of the damage.
- * Always replace fuses with others of some amperage.



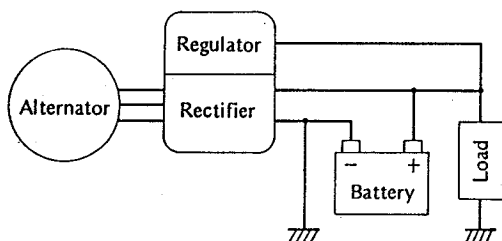


ELECTRIC SYSTEM



Charging System

K3



Regulator rectifier

The charging system consists of an alternator and regulator/rectifier. The regulator is an aluminum box placed under the gas tank. The alternator generates the current required by the electrical circuits. The generated current is a three phase alternating current (AC), which is changed to direct current (DC) and controlled by a solid-state regulator/rectifier to supply an even voltage to the circuit components.

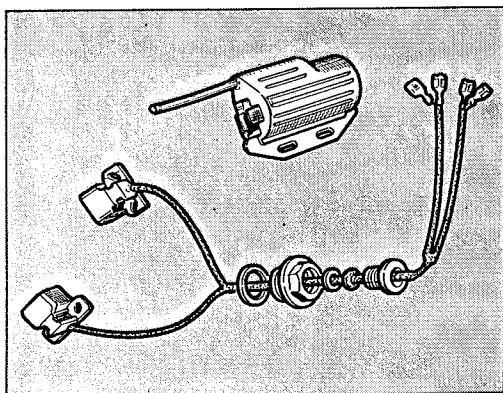
There are a number of important precautions that are musts when servicing the charging system. Cautions that are applied to the individual sections are mentioned in each section. Failure to observe these rules can result in serious system damage. Learn and observe all the rules below.

CAUTION

When handling the regulator/rectifier, observe the following to avoid damage to the regulator/rectifier.

1. Do not reverse the battery lead connections. This will burn out the zener diode.
2. For the regulator/rectifier to function properly, the battery must be charged to near capacity. If the battery is badly discharged, charge it before installing it in the motorcycle.
3. Never remove the battery lead connections when engine is running, regulator will suffer serious damage.

Note: When the battery load is 12 ~ 14 Volts, the regulator output will be of 4 ~ 2 Amps.



Ignition coil test.

If the coil does not produce an adequate spark, or if either the primary or secondary winding does not have the correct resistance, replace the ignition coil.

With the highest ohmmeter range, check for continuity.

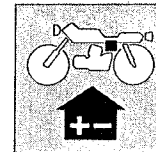
Primary winding (Low tension): $8800 \Omega \pm 20\%$

Secondary winding (High tension): $40 \Omega \pm 10\%$.

Pick-up test

Check if there is continuity with the Ohmmeter.

The resistance should be $220 \Omega \pm 5\%$.

**Spark plug.**

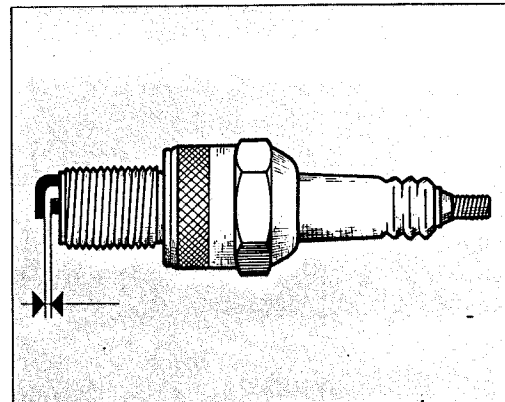
The spark plug ignites the fuel/air mixture in the combustion chamber. To do this effectively and at the proper time, the correct spark plugs must be used, and the spark plugs must be kept clean and adjusted.

Recommended spark plugs are the Champion L82 YC or equivalent set to a 0.6 (0.02 in) gap.

If a spark plug of the wrong heat range is used, the electrodes may not heat enough to keep all the carbon burned off, but cool enough to keep from damaging the engine and the plug itself—about 400 + 800 °C (750 + 1450° F).

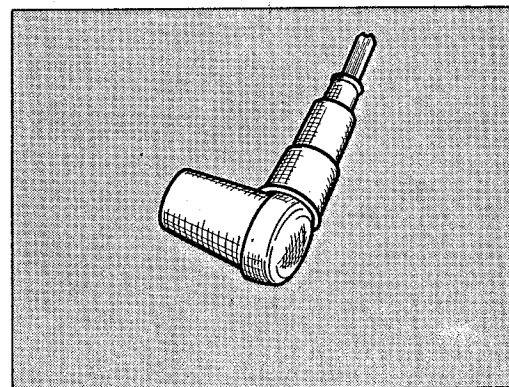
CAUTION

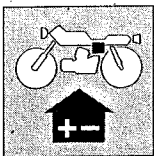
- * The carbon on the electrodes conducts electricity, and can short the center electrode to ground by either coating the ceramic insulator or bringing across the gap. Such short will prevent an effective spark.
- * Carbon build-up on the plug can also cause other troubles. It can heat up red-hot and cause preignition and knocking, which may eventually burn a hole in the top of the piston.
- * Using the wrong type of spark plug can make the engine run too hot (resulting in engine damage) or too cold (with poor performance, misfiring and stalling). The standard plug has been selected to match the normal usage of this motorcycle in combined street and highway riding.

**Spark plug caps.**

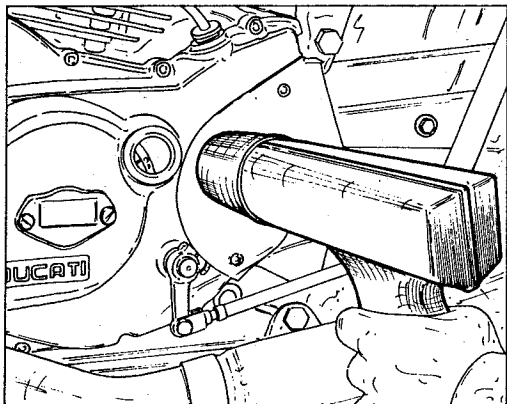
Special spark plug caps are used on this motorcycle.

These special caps must be used to avoid starting and running difficulties.





ELECTRIC SYSTEM

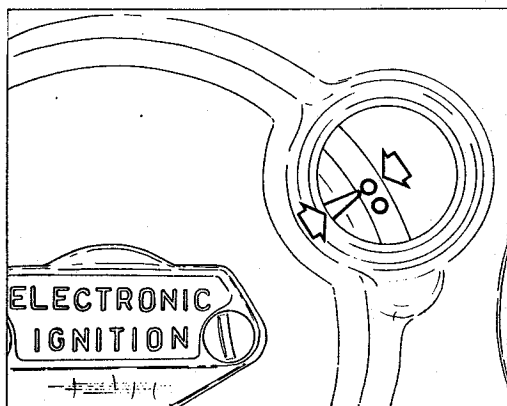


Ignition timing advance inspection.

The ignition cover is provided with a clear plastic inspection window for the timing advance inspection with a strobe light.

To check timing advance proceed as follows:

- Connect a strobe light to the horizontal cylinder spark plug wire and to the battery in the manner prescribed by the manufacturer of the strobe light in order to check the ignition timing under operating conditions.
- Turn on the ignition switch and engine stop switch. Start the engine, and direct the strobe light at the timing marks.
- Below 1,600 r.p.m., the first of the two timing marks must be aligned with the white timing arrow.
- Above 2,900 r.p.m., the advanced timing mark must be aligned with the white timing arrow.

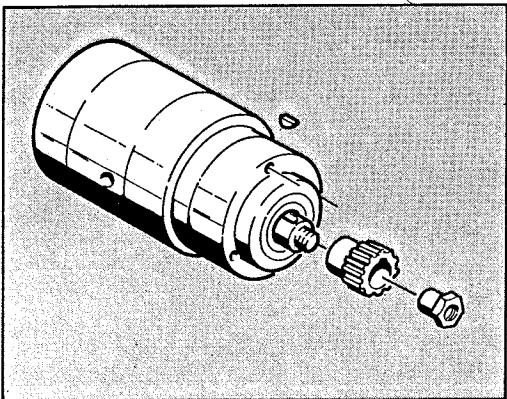
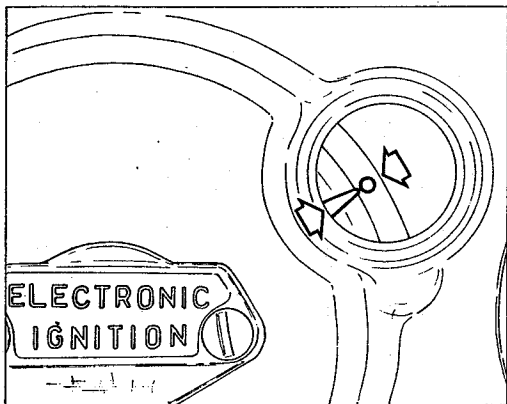


Timing Advancing:

Advance begins:	1,700 r.p.m.
Full advance:	2,900 r.p.m.

Note: If the timing is not correct, check the pick-up to ignition flywheel gap.

Follow the same procedure for vertical cylinder.



Electric starter engine.

- Engine type: SJCE
- Power output: 367 W/12 volts
- Spinning sense: anticlockwise
- Pinion retaining nut torque: 22 Nm, 2.2 Kg/m, 15.9 lbs/ft



- N.1 Engine doesn't start, starting difficult
 N.2 Lights do not work properly
 N.3 Engine misses or produces low power
 Start motor does not run

N

Engine Doesn't Start, Starting Difficulty

CAUSE	REMEDY
Stop/Run switch in OFF position	Switch to "RUN" position
Gear engaged	Shift to neutral
Gas tank to carburetor gasoline hoses obstructed or clog	Blow with compressed air
Carburetor inlet filter screen clog	Remove the screen and blow with compressed air
Gas tank fuel valve filter obstructed	Remove filter and blow with compressed air
Jammed Carburetor float	Remove the float bowl and clean
Punctured float	Change it
Obstructed jet	To clean passage, apply strong air jet
Dirty or defective	Clean or replace Check electrode gap
No compression	Check: Spark plugs are tight Valves seat properly Piston rings worn out
No spark	Check stop/run switch Ignition wires not properly plugged
No spark on only one spark plug	Clear or replace spark plug, check electrode gap. Check ignition coil wires, or replace it. Check pick-up wires, replace if required.





Lights do not work properly

CAUSE

REMEDY

Battery is down or often runs down

Check battery condition and charging circuit.

Check rectifier regulator. If defective must be replaced.

To check if charging circuit works, procede as follows:

- Disconnect the wire from terminal + of the battery and place a direct current ammeter between terminal and wire (possibly with 0 in center).
- Start engine until a speed in 5.000 is reached. The ammeter must read the following values.
 - a) max. current 10 A if the battery is almost dead.
 - b) min. current 1 A if the battery is fully charged.

Test must be carried out with lights off.

CAUTION

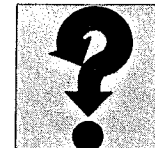
* The ammeter must be connected always with the engine off.

Electrical consumption test.

- Make sure that all the bulbs work.
 - a) with low beam lights on, the ammeter must read zero at approx. 2,200 r.p.m.
 - b) with lights off, the ammeter must read zero at approx. 1,000 r.p.m.

Ignition switch is off, but battery quickly goes dead.

Check that no ground contact is in the system.



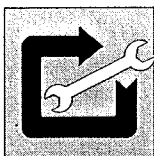
Engine misses or produces low power

CAUSE	REMEDY
Petrol flow to carburetor not steady.	Check carburetor inlet screen filter, fuel valve filter, gasoline hoses.
Main jet is partially obstructed.	Blow with compressed air.
The slide of either one or both carburetors does not open fully.	Adjust valve acting on cable adjusting screw.
Poor quality gasoline.	Replace petrol.
Unsuitable type of spark plugs.	Check for the right heat range.
Loose spark plug.	Tighten spark plug to recommended torque.
Ignition coil to spark plug wire shorted.	Change it.
Spark plug electrode gap.	Check it.
Dirty spark plug electrodes.	Clean them.
IC unit defective.	Change it.
Defective ignition coil.	Replace it.
Defective ignition pick-up.	Replace it.
Generator stator coil.	Replace it.
Clogged muffler	Replace it.
Clogged Spark Arrester.	Clean it.

Start motor does not run

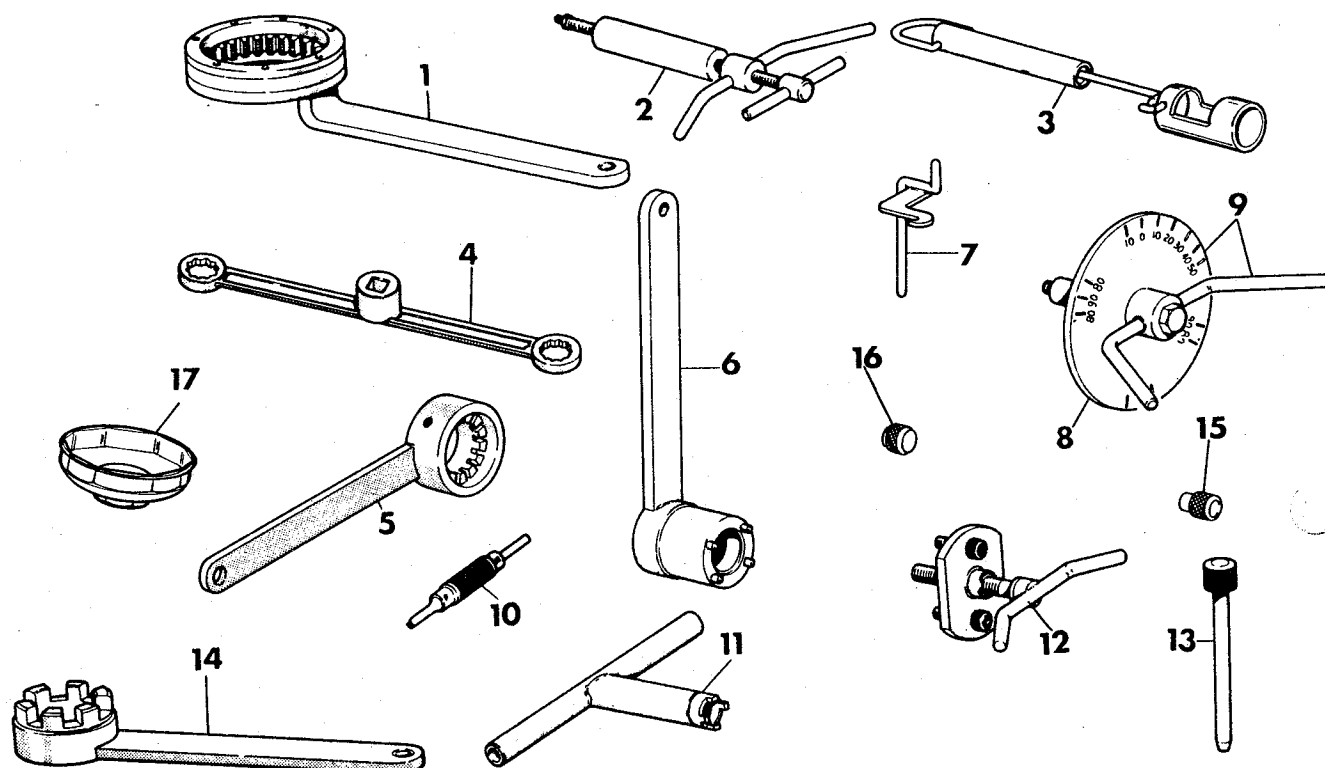
CAUSE	REMEDY
Dead battery.	Check and charge battery.
Defective start motor button.	Replace it.
Defective starter relay.	Replace it.
Defective start motor.	Replace it.





SPECIFIC TOOLS

W



No.	Nr. Code. CAGIVA	Nr. Code DUCATI	
1	(42403)	88713.0146	Clutch drum locking wrench
2	(42404)	88713.0120	Rocker pin extractor
3	(42406)	88713.0748	Timing belt tensioner
4	(42407)	88713.0718	Wrench for cylinder-head nut
5	(42652)	88713.0710	Alternator retain, wrench for nut locking-
6	(42409)	88713.0137	Crankshaft gear retaining wrench for nut locking
7	(42410)	88713.0143	Closing rocker & spring assembling tool
8	(42411)	98112.0002	Protractor wheel
9	(42412)	88713.0123	Graduated disc bearing tool for advance checking with disc
10	(42413)	88713.0114	Tool for removal of connector pins
11	(42414)	88713.0139	Timing pulley nut locking wrench
11	(42415)	88713.0711	Timing pulley nut locking wrench
12	(42416)	88713.0144	Tool for removal of chain cover
13	(42405)	88713.0262	Rocker assembi. pin
14	(42415)	88713.0711	Timing pulley retaining wrench
15	(44119)		Lower spacer
16	(44120)		Lower spacer
17	(50048)	0675.03210	Oil filter cartridge removing tool